

THE PINK BEDS
OF THE
PISGAH NATIONAL FOREST
AS A
SOURCE OF WATER SUPPLY
FOR THE
CITY OF ASHEVILLE

BY THE
Howerton Engineering Company
1927-28

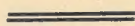
Stanley H. Houghton



City of Asheville—Partial Business District—July, 1928

O-3710

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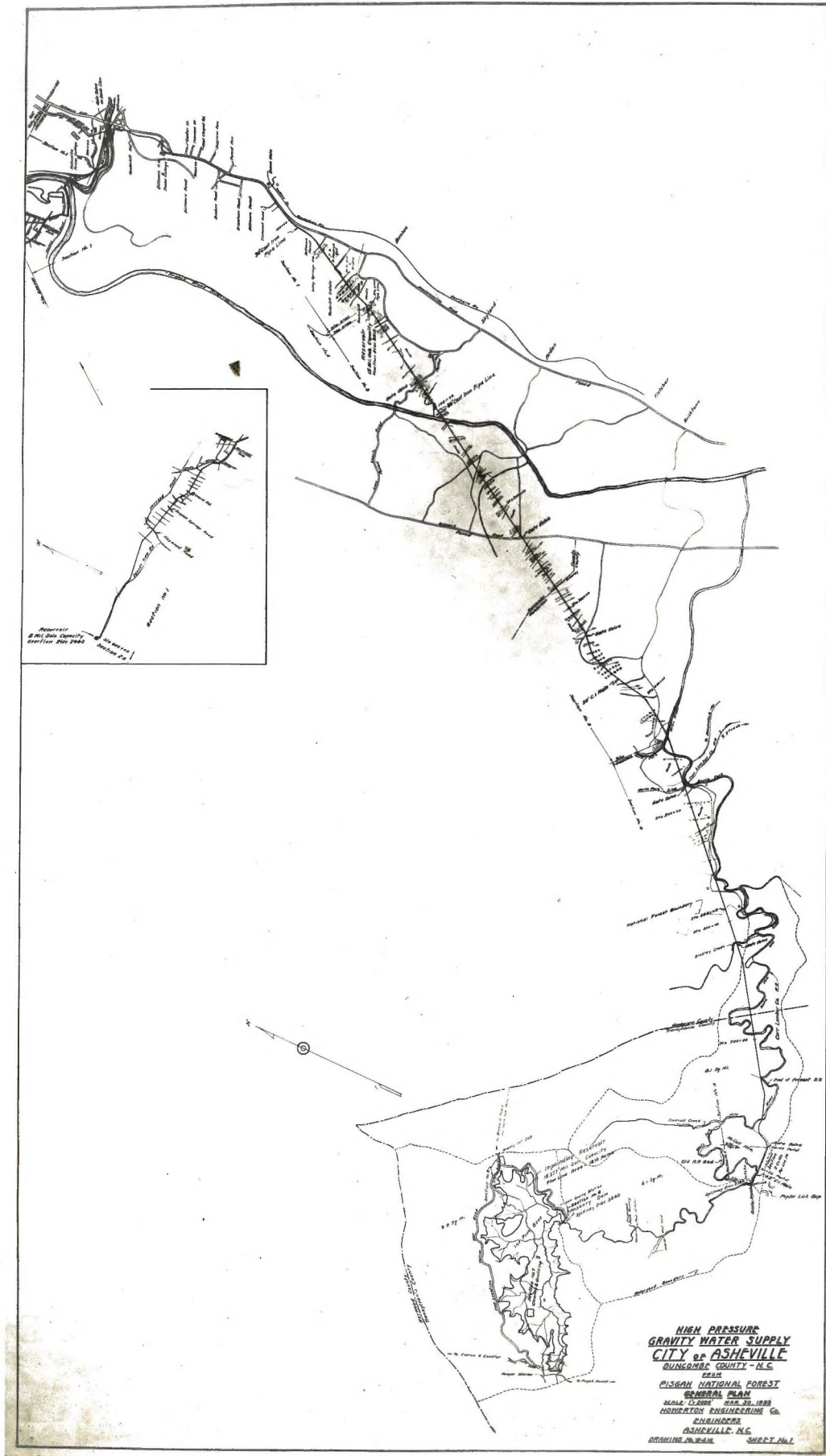


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FOREWORD.

There flows in the Pisgah National Forest, at an elevation of 3132 feet above the sea and surf, a crystal, clear, sparkling stream that may be impounded with reinforced concrete into a fifteen billion gallon mountain lake, securely and safely anchored on a foundation of everlasting stone of the quality and as enduring as that used in the foundations of buildings in the City of Asheville, a foundation sealed by nature and unbreakable, that has existed for a longer period than the memory and existence of man and which will endure as long as man inhabits the earth. The sparkling water from this unique storage will, when released, become one vast cataract and will aerate and revivify in passing through the existing tortuous, rocky gorge to the point of intake four and one-half miles below where it is to be taken up in a cast iron main and be inducted through tunnel and the valley of the French Broad for a distance of fifteen and one-half miles and discharged into a fifteen million gallon reinforced concrete reservoir situated on Frady Mountain. From this distribution reservoir, the water will be released into the present high pressure water system of the City of Asheville and into the present reservoirs and, in addition, through a 24" cast iron main traversing that part of the City of Asheville West of the French Broad River, to an additional five million gallon reinforced concrete, pressure regulating and distribution reservoir located on Deaver View.

The laying of a 30" cast iron main to the point of intake will more than double our present water supply. The construction of the dam and the installation of an additional cast iron main paralleling the first will augment our water supply by thirty million gallons per day. The proposed development and financing would be distributed over a period of approximately four years. The ultimate capacity to which the Pink Beds and the South Mills River is susceptible of development is sixty million gallons per day. This source of supply is available through the Forestry Department of the U. S. Government for the asking. As a high pressure source of supply, it can be economically developed to produce forty-five million gallons daily. The U. S. Government, through its engineers, has found as a fact, after a full investigation, that Asheville needs this source of supply. We find, after a most thorough and careful investigation, that the City of Asheville needs this source of water supply and that it should be immediately developed along the lines recommended.

This the 25th day of July, 1928.

Respectfully submitted,

HOWERTON ENGINEERING COMPANY.

LOCATION	Overflow or Spillway Elevation	Distance From Distribution Reservoir	Distance From City of Asheville
Pink Beds Dam—127 Ft. High-----	3260	106,306 Ft.	133,360 Ft.
Intake on South Mills River-----	2790	82,600 Ft.	109,600 Ft.
Dam Near Mouth of Cantrell Creek-----	2700	79,620 Ft.	106,620 Ft.
Intake at Mouth of Cantrell Creek-----	2590	83,100 Ft.	110,100 Ft.
Dam Below Bradley Creek-----	2400		84,480 Ft.
Frady Mt. Distribution Reservoir-----	2515		27,000 Ft.
Deaver View Pressure Equalizing Reservoir-----	2440		8,603 Ft.
Low Pressure Distribution Reservoir-----	2300		
North Fork Stream Bed, Burnett Dam Site-----	2475	70,100 Ft.	70,100 Ft.
North Fork Intake -----	2740	85,000 Ft.	85,000 Ft.
Burnett Dam—155 Ft. High-----	2620	70,100 Ft.	70,100 Ft.
Bee Tree Reservoir -----	2668	52,640 Ft.	52,640 Ft.
Bee Tree Intake -----	2676	56,300 Ft.	56,300 Ft.
Beaucatcher Concrete Reservoir -----	2440		Located in Asheville
Stand Pipe on Beaucatcher Mt. -----	2449		Located in Asheville
White Fawn Reservoir -----	2440		Located in Asheville

NOTE: Overflow or spillway elevation is the elevation of the water surface when Intake, Reservoir, or Dam is full of water.

THE PINK BEDS—IMPOUNDING RESERVOIR
AREAS AND VOLUMES FOR VARYING HEIGHTS OF DAM

Contour Elev.	Area in Acres	Volume Million Gal.	Total Vol. Million Gal.	Net Height of Dam	
3133	0				
		0.827			
3140	1		0.827	7	
		7.948			
3150	4		8.774	17	
		28.892			
3160	14		37.666	27	
		94.809			
3170	44		132.475	37	
		250.187			
3180	109		382.662	47	
		457.765			
3190	172		840.427	57	
		711.169			
3200	264		1551.596	67	
		1069.730			
3210	392		2621.325	77	
		1510.223			
3220	535		4131.548	87	
		1992.463			
3230	689		6124.011	97	
		2517.933			
3240	858		8641.943	107	
		3082.703			
3250	1035		11784.646	117	
		3652.780			
3260	1210		15377.426	127	This Height Used
		4195.387			
3270	1370		19572.812	137	
		4721.178			
3280	1530		24293.989	147	
		5214.405			
3290	1670		29508.395	157	
		5670.061			
3300	1810		35178.455	167	

COST SUMMARY

The 1st and 2nd Units Complete:—

	Delivering Water Into Asheville	Delivering Water to Deaver View Reservoir
Impounding Dam and Reservoir-----	\$1,549,735.25	\$1,549,735.25
Intake and Tunnel -----	156,985.55	156,985.55
1-30" C. I. Pipe Line to Frady Mt. Reservoir—from Intake -----	1,297,109.54	1,297,109.54
Frady Mt. Distribution Reservoir-----	301,042.13	301,042.13
1-24" C. I. Pipe Line from Distribution Reservoir to Asheville -----	270,000.00	270,000.00
Total, delivering 15 M. G. D. into Asheville-----	\$3,574,872.47	
Additional necessary to deliver water to Deaver View plus Deaver View Reservoir -----		468,562.59
Total delivering water to Asheville and on to Deaver View Reservoir --		\$4,043,435.06

1st and 2nd Units Complete:	Delivering into Asheville	Delivering to Deaver View Reservoir
Delivering 15 M. G. D. at a cost per million of-----	(1) \$238,300.00	\$269,600.00
The 1st, 2nd and 3rd Units Complete:	Delivering into Asheville	Delivering to Deaver View Reservoir
1st and 2nd Units Complete: -----	\$3,574,872.47	\$4,043,435.06
Additional necessary to complete 3rd unit:		
1-30" C. I. Pipe line to Frady Mt. Reservoir from Intake -----	1,297,109.54	1,297,109.54
1-20" C. I. Pipe line from Dist. Reservoir to Asheville -----	202,500.00	202,500.00
Total, delivering 30 M. G. D. into Asheville-----	\$5,074,482.01	
Additional necessary to deliver water to Deaver View Reservoir -----		468,562.59
Total delivering water to Asheville and on to Deaver View Pressure Reg. Reservoir -----		\$5,543,044.60
1st, 2nd and 3rd Units Complete:—	Delivering into Asheville	Delivering to Deaver View Reservoir
Delivering 30 M. G. D. at a cost per million of-----	(2) \$169,100.00	\$184,800.00

Totals marked (1) and (2) are for supplying the water to the Asheville mains and are comparative to the systems now in use, in that they would all have the same point of delivery, but totals (1) and (2) have a lower cost with a larger delivery in gallons per day.

July 25, 1928.

MR. GALLATIN ROBERTS, *Mayor,*
MR. L. B. ROGERS,
Commissioner of Public Works,
MR. C. H. BARTLETT,
Commissioner of Public Safety,
of the City of Asheville, North Carolina.

Subject: L—Uses—Pisgah—City of Asheville
Watershed—Engineering.

Gentlemen:

On September 3, 1927, we were employed by you to make a complete survey and secure all engineering data and do everything incident and necessary looking to the development of the water supply possibilities of the South Fork of the Mills River, including the Pink Beds basin and the territory immediately below, as per application of the City of Asheville to the Forestry Service of the Department of Agriculture of the U. S. Government, and, in addition, to prepare estimates, plans, specifications and a report outlining in detail our findings for your approval and the approval of the Forestry Service.

All of the above information is contained in this report, and in the plans and specifications which are being submitted under separate cover.

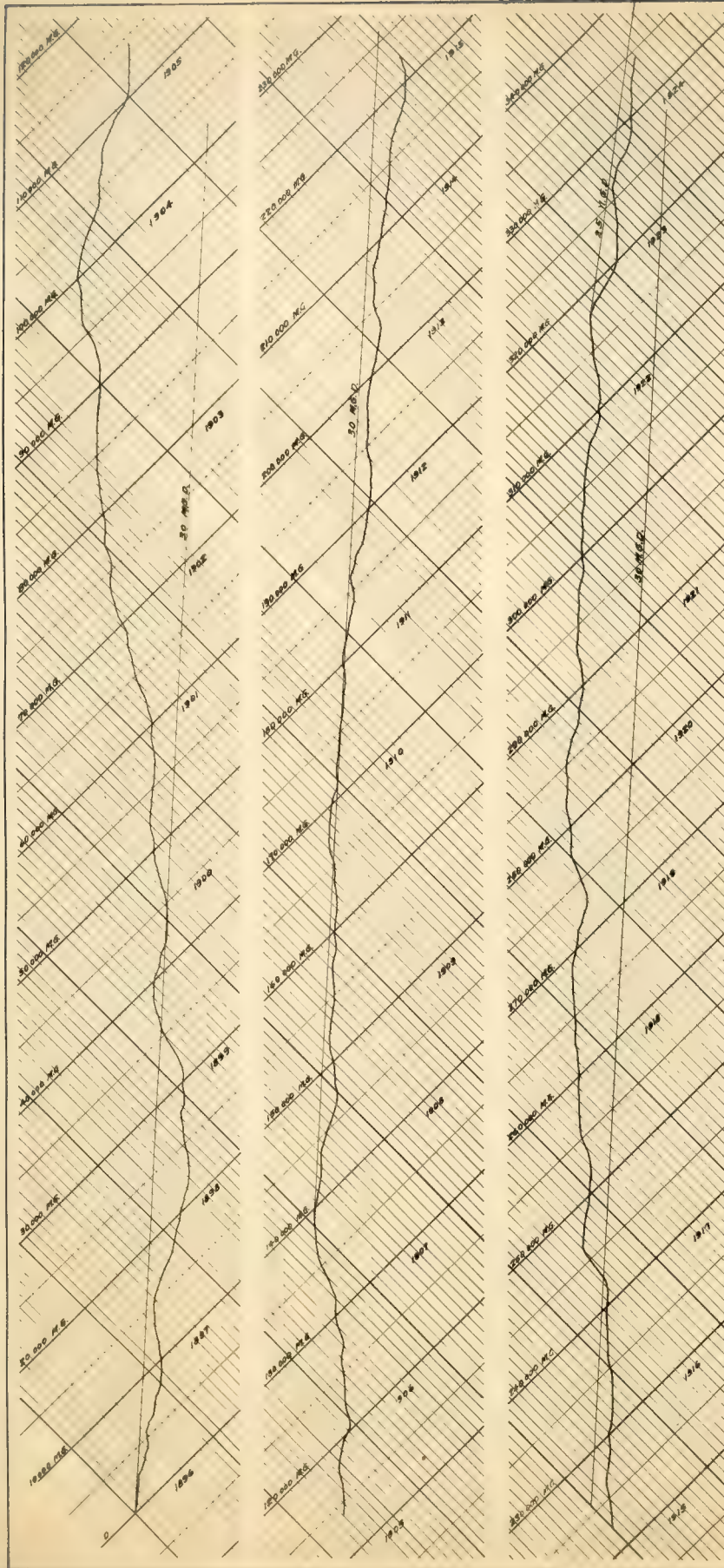
On September 12, 1927, we placed several engineering parties in the field, beginning at the lower end of the pipe line and working up the French Broad valley into the Mills River valley and thence up into the Pink Beds. This work has been pushed as rapidly as practicable, but has been somewhat retarded during the winter months because of unfavorable weather conditions, together with the extreme roughness of topography and the abundance of underbrush and laurel.

We have, during this time, made a complete topographical survey of the Pink Beds basin up to elevation of 3300 and have prepared a map from the field data, showing the contours, together with all water courses, roads, and other features present in that locality. From this map, we are able to determine the quantity of water which can be impounded in this reservoir for any height of dam which it would be practicable to build. These volumes with the corresponding heights of the dam are shown on Plate No. 3 of this report. Note: Page numbers refer to this report and sheet numbers refer to the plans.

The data compiled by J. L. Ludlow, acting as consulting engineer for the Board of Water Commissioners of the City of Asheville during 1926, seems to be very reliable and is probably the most accurate source of information of this character which can be obtained at this time. His computations appear to be correct and we have used a portion of them, to assist us in the construction of a mass curve diagram. Since February, 1926, actual measurements have been kept of the rainfall and run-off in the Pink Beds basin by the U. S. G. S. and we have prepared from these two sources of information a mass curve diagram covering a period from 1896 to May, 1928.

Table below is computed from the observed flow from Pink Beds:

1926	Flow Pink Beds c. f. s.	Days in Period	Gallons— Millions	Total Gallons— Millions
Wk. No.				
9	45.10	7	204.04	344,608.09
10	43.00	7	194.54	344,802.63
11	33.70	7	152.47	344,955.10
12	27.30	7	123.51	345,078.61
13	30.70	7	138.89	345,217.50
14	41.40	7	187.30	345,404.80



**HIGH PRESSURE
GRAVITY WATER SUPPLY
CITY of ASHEVILLE**
BUNCOMBE COUNTY - N.C.
FROM
PISCATAWAY NATIONAL FOREST
**MASS CURVE OF THE
PINK BEDS RESERVOIR SITE**
MAY 21, 1928
HOWERTON ENGINEERING CO.
ENGINEERS
ASHEVILLE, N.C.
DRAWING No. W-416 SHEET No. 39

1926	Flow Pink Beds c. f. s.	Days in Period	Gallons— Millions	Total Gallons— Millions
Wk. No.				
15	50.00	7	226.21	345,631.01
16	37.00	7	167.40	345,798.41
17	24.57	7	111.16	345,909.57
18	20.00	7	90.48	346,000.05
19	20.71	7	93.70	346,093.75
20	20.14	7	91.12	346,184.87
21	14.30	7	64.70	346,249.57
22	13.43	7	60.76	346,310.33
23	10.93	7	49.45	346,359.78
24	11.03	7	49.90	346,409.68
25	12.49	7	56.50	346,466.18
26	8.76	7	39.63	346,505.81
27	9.96	7	45.05	346,550.86
28	5.66	7	25.60	346,576.46
29	4.14	7	18.73	346,595.19
30	20.94	7	94.73	346,689.92
31	45.14	7	204.21	346,894.13
32	16.57	7	74.83	346,968.96
33	12.96	7	58.62	347,027.58
34	10.09	7	45.65	347,073.23
35	6.69	7	30.26	347,103.49
36	12.19	7	55.13	347,158.62
37	9.79	7	44.27	347,202.89
38	7.70	7	34.82	347,237.71
39	8.37	7	37.86	347,275.57
40	11.47	7	51.89	347,327.46
41	8.83	7	39.95	347,367.41
42	7.51	7	33.98	347,401.39
43	8.46	7	38.27	347,439.66
44	6.94	7	31.40	347,471.06
45	14.70	7	66.50	347,537.56
46	58.97	7	266.78	347,804.34
47	31.71	7	143.46	347,947.80
48	35.29	7	159.65	348,107.45
49	20.57	7	93.06	348,200.51
50	22.00	7	99.53	348,300.04
51	19.36	7	87.58	348,387.62
52	79.37	8	410.34	348,797.96
1927				
1	34.71	7	157.03	348,954.99
2	25.29	7	114.41	349,069.40
3	25.29	7	114.41	349,183.81
4	22.71	7	102.74	349,286.55
5	24.43	7	110.52	349,397.07
6	20.21	7	91.43	349,488.50

1927	Flow Pink Beds c. f. s	Days in Period	Gallons— Millions	Total Gallons—
Wk. No.				
7	27.00	7	122.15	349,610.65
8	36.14	7	163.50	349,774.15
9	27.00	7	122.15	349,896.30
10	47.57	7	215.21	350,111.51
11	63.43	7	286.96	350,398.47
12	34.57	7	156.39	350,554.86
13	29.86	7	135.09	350,689.95
14	23.43	7	106.00	350,795.95
15	22.71	7	102.74	350,898.69
16	22.71	7	102.74	351,001.43
17	20.79	7	94.05	351,095.48
18	18.07	7	81.75	351,177.23
19	15.17	7	68.63	351,245.86
20	13.66	7	61.80	351,307.66
21	12.07	7	54.60	351,362.26
22	22.00	7	99.53	351,461.79
23	17.14	7	77.54	351,539.33
24	18.07	7	81.75	351,621.08
25	19.13	7	86.54	351,707.62
26	11.77	7	53.25	351,760.87
27	10.49	7	47.46	351,808.33
28	14.16	7	64.06	351,872.39
29	19.46	7	88.04	351,960.43
30	14.51	7	65.64	352,026.07
31	11.34	7	51.30	352,077.37
32	21.10	7	95.47	352,172.84
33	34.00	7	153.82	352,326.66
34	13.99	7	63.29	352,389.95
35	15.40	7	69.67	352,459.62
36	10.03	7	45.38	352,505.00
37	8.90	7	40.26	352,545.26
38	7.34	7	33.21	352,578.47
39	5.81	7	26.28	352,604.75
40	5.54	7	25.06	352,629.81
41	18.87	7	85.37	352,715.18
42	13.54	7	61.25	352,776.43
43	9.33	7	42.21	352,818.64
44	9.49	7	42.93	352,861.57
45	8.56	7	38.73	352,900.30
46	32.67	7	147.80	353,048.10
47	21.43	7	96.95	353,145.05
48	23.07	7	104.37	353,249.42
49	76.00	7	343.82	353,593.24
50	56.29	7	254.66	353,847.90
51	46.29	7	209.42	354,057.32
52	36.50	8	188.71	354,246.03

1928	Flow Pink Beds c. f. s	Days in Period	Gallons— Millions	Total Gallons—
Wk. No.				
1	47.43	7	214.57	354,460.60
2	38.57	7	174.49	354,635.09
3	25.86	7	116.99	354,752.08
4	29.71	7	134.41	354,886.49
5	21.07	7	95.32	354,981.81
6	25.57	7	115.69	355,097.50
7	26.29	7	118.94	355,216.44
8	27.43	7	124.09	355,340.53
9	22.71	7	102.74	355,443.27
10	26.43	7	119.57	355,562.84
11	28.86	7	130.56	355,693.40
12	30.14	7	136.35	355,829.75
13	33.00	7	149.29	355,979.04
14	38.14	7	172.55	356,151.59
15	51.57	7	233.30	356,384.89
16	35.00	7	158.34	356,543.23
17	59.57	7	269.49	356,812.72
18	46.00	7	208.10	357,020.82
19	78.00	7	352.87	357,373.69
20	39.29	7	177.75	357,551.44
21	48.71	7	220.36	357,771.80

From a study of this diagram, it will be seen that 1925, 1926 and 1927 have constituted the driest period during this entire 32 years. It will be seen further that the 15 billion gallon impounding reservoir would have been sufficient to have provided during this entire period a delivery of over 25 million gallons per day from the Pink Beds area alone, which comprises 9.9 square miles. Under normal conditions the quantity of water that could be secured in this same area will be in excess of 30 million gallons per day. The height of dam necessary to impound 15 billion gallons will be 127 feet above the present stream bed or a total height above foundation of approximately 150 feet. This gives a spillway elevation of 3260. Since it will not be necessary to have the intake of the delivery pipe line at this high an elevation, the pipe line intake has been located just below the mouth of Brushy Branch which is approximately $4\frac{1}{2}$ miles below the dam site at the Pink Beds. Here we have shown a small intake dam as indicated on sheet No. 19 which is approximately 23 feet in height, 80 feet in length and has a spillway elevation of 2790. At this point, the natural flow of the stream will be diverted into a cast iron pipe line and will have sufficient elevation to provide the head necessary to deliver the entire water supply into the present distribution mains of the City of Asheville, economically, and at a sustained pressure equal to or greater than the present operating head. At the point of intake, we will have 16 square miles of watershed which will produce, on the same ratio as the Pink Beds annual run-off, of the dry years of 1925, 1926 and 1927, 24 million gallons per day or $1\frac{1}{2}$ million gallons per day per square mile. From this point the water is carried down the South Mills River valley in a thirty-inch cast iron pipe line, leaving the South Mills River at its confluence with North Mills River, it passes into the French Broad valley south of Asheville where it discharges into a reinforced concrete reservoir on Frady Mountain. From this point, approximately six miles out, the distribution line extends into the City of Asheville, connecting into the present 24-inch distribution main at McDowell and Choctaw Streets and also into the present distribution system of West Asheville, by running up State Street, paralleling Haywood Road, and continuing along the Deaver View Road about one and one-half miles beyond the Southern Railway crossing to a reservoir on Deaver View Mountain.

The utilization of the Mills River area lends itself very readily to a progressive development by successive units which will be far more practical and much less burdensome to the consumers than the development of any other area in this region. We have planned as the first unit the installation of a thirty-inch cast iron pipe line as outlined above, which will deliver into the distribution reservoir and the City of Asheville 15 million gallons per day, even after the pipe line has become old and encrusted, which should be sufficient to provide for the increasing consumption until such time as a second line could be installed.

THE FIRST CONSTRUCTION UNIT HAS BEEN DIVIDED INTO FIVE SECTIONS AS FOLLOWS:

Section No. 1 consists of a 24-inch cast iron distribution main extending from the distribution reservoir on Frady Mountain into the City of Asheville and on through West Asheville to a 5,000,000 gallon pressure regulating reservoir on Deaver View Mountain just beyond the west limits of the City, at which point it will be possible to deliver 4.7 million gallons per day. The connection at Choctaw and McDowell streets will be capable of delivering a maximum of 16 million gallons per day. This line will be provided with necessary gates, pressure air valves, air and vacuum valves and pressure relief valves which will insure its satisfactory operation under varying demands of draft.

Section No. 2 consists of a reinforced concrete distribution reservoir situated on Frady Mountain near Busbee, whose spillway elevation will be 2515 ft. Numerous borings have been made at this site which indicate that solid rock foundation will be encountered under the entire structure. There will be an inlet and an outlet gate house which will contain the necessary valves to regulate the flow of water into and out of the reservoir. There is planned 2800 feet of roadway leading from the present County Road and circling around the reservoir as indicated on sheet No. 21, which is also a part of this section. The reservoir is surrounded by cyclone fencing, outside of which is a ten-foot walkway, flanked with concrete lamp posts having lights of suitable capacity to illuminate both the reservoir and roadway. Inside of the fencing is a second sidewalk for the convenience of the caretaker. Water level with the reservoir full is 2515 which, allowing for loss in head due to friction in the pipe line, will approximately equal or slightly exceed the operating head in the present City mains. The necessary current for operating lights will be secured from the transmission line of the Carolina Power Company which follows the old Hendersonville Road opposite Frady Mountain.

Section No. 3 consists of a 30-inch cast iron pipe line beginning at Frady Mountain reservoir and extending in a southwesterly direction into the South Mills River valley and ending at a point approximately where the North and South forks of Mills River converge. This division was made due to the fact that from this point on up South Mills River, the pipe line is within easy reach of the Carr Lumber Company's railway over which the material for section No. 4 may be hauled, provided satisfactory arrangements can be made with that Company. Section No. 3 is approximately 44,000 feet in length.

Section No. 4 is a continuation of the 30-inch cast iron pipe line which begins at the terminus of section No. 3 as indicated above and extends approximately 35,000 feet up the South Mills River valley and ends at the foot of McCall Mountain at the portal of the proposed tunnel.

Section No. 5 consists of an 1800 foot tunnel through McCall Mountain, the intake dam, and a 42-inch cast iron pipe line which begins at the intake and runs down the River and through the tunnel just mentioned. This 42-inch pipe has a capacity of approximately 34 million gallons per day and is sufficient to supply the full capacity of a second pipe line when it is deemed advisable to supply additional water to the City of Asheville. By using the 42-inch size now, we dispense with the necessity of placing a second pipe line through the tunnel, which would be more expensive to install at some future date. By tunneling through McCall Mountain we save approximately 2.8 miles in distance compared to the line following the

river, which means a saving in money of at least \$200,000.00. The proposed intake spillway elevation is 2790 as compared with an intake near the mouth of Cantrell Creek, as suggested in the Ludlow Report, which would be at an approximate elevation of 2590. The points of intake are the same distance from Asheville, while the tunnel line gives 200 ft. more head and consequently affords the same delivery of water through a smaller pipe line. At the intake dam, which is to be constructed of concrete, will be installed the necessary trash racks, screens and gates, and a 42-inch venturi meter which will have a Recorder-Indicator-Register by which the amount of water entering the pipe line will always be known, so that an accurate check can be made against the amount of delivery at the distribution reservoir where a second venturi meter will also be installed. In the gate house at the intake dam sufficient space has been provided to install a chlorinator, which has been left to the option of the City. At the opposite end of the intake dam there will be constructed a small power house containing a 13-inch turbine and direct connected generator which will generate sufficient current to provide for the lights at the dam and through the tunnel. We believe a small separate power unit at this point will be much more satisfactory and inexpensive than any other system. Water which has been impounded in the reservoir will be allowed to run free down the old stream channel, a distance of $4\frac{1}{2}$ miles, thereby insuring at the point of intake a quality of water equal, if not superior, to that which at present flows down the stream at this point.

THE SECOND UNIT IS DIVIDED INTO THREE SECTIONS AS FOLLOWS:

Section No. 6 consists of a gravity type concrete dam to be constructed immediately below the outlet of the Pink Beds basin as shown on sheet No. 38 and will be built to the elevation and dimensions as shown on sheets No. 43 to 48.

On January 25, 1928, the City of Asheville let the contract for diamond drill borings to be made at the proposed Pink Beds dam site to the Southern Drilling Co., and on February 14, 1928, this work was begun by them and carried on to completion under the direction of the Howerton Engineering Co. A total of 45 test holes were drilled into solid rock as indicated on sheets Nos. 40 to 42 and a satisfactory foundation material for the dam was encountered. The overburden at the extreme East end was slightly more than was anticipated and will necessitate the building of a short concrete core wall at this point. These test holes were drilled in all instances to a depth necessary to secure 20 feet of sound, impervious, solid rock which would sustain a pressure test in excess of the static head for a period of three minutes. We are submitting as a part of this report the findings of Prof. A. M. Miller, a geologist of national reputation, who has investigated the geology of the dam site and the Pink Beds basin with respect to its fitness for this purpose.

A cut-off wall will be constructed under the upper face of the dam 10 feet below foundation level and grout holes will be drilled approximately 10 feet below the bottom of the cut-off wall for the entire length of the dam and these holes will be filled with grout under air pressure which shall exceed twice the static head at that point. This precaution is taken to prevent seepage water from passing under the upstream toe of the dam, but if any water should pass under the cut-off wall, drainage wells are provided immediately behind the cut-off wall which extend to the solid rock under the foundation of the dam, through which this water will be carried up into an inspection gallery and thence taken out through a drainage pipe and allowed to escape into the old stream bed below the dam. The highest pressure exerted by the dam upon the foundation underneath will not exceed ten tons per square foot, which is a very small part of the total weight per square foot which this foundation material could satisfactorily support. Inside the dam there will be constructed inspection galleries of sufficient dimensions to allow for proper inspection of construction joints and to determine whether any leakage is occurring through the dam itself. Construction joints are provided with keyways, copper strips and asphalt filler to prevent passing of any water at these points. The dam itself is provided with a class A concrete lining two feet in thickness on both faces of the dam, which is water-proofed with Celite and which will protect the cyclopean masonry underneath from the weathering action of the elements. A gravity type dam was selected because we believe it impractical to construct anything but a masonry dam at this location which seems to be ideal for a gravity type dam.

Section No. 7 consists of the clearing and grubbing of the reservoir site above the dam.

Section No. 8 consists of the reconstruction of the Pink Beds roadway near the margin of the impounded lake.

The construction of the 2nd unit will provide 15 billion gallons storage which will supply continuously, even during as dry a period as 1925, 1926 and 1927, 25 M. G. D. as previously stated, and under normal rainfall conditions will supply in excess of 30 M. G. D.

THE 3RD UNIT OR STAGE OF DEVELOPMENT, will consist of the installation of a second C. I. pipe line connecting with the 42-inch C. I. pipe line, of the first unit, at the lower end of the tunnel and extending to the Frady Mountain reservoir. This line will supply an additional 15 M. G. D. using a 30" C. I. pipe.

A FOURTH UNIT CAN BE PROVIDED NEAR THE MOUTH OF CANTRELL CREEK which will be a low pressure proposition unless an impounding dam is built. This drainage area contains approximately 8.5 sq. miles, which will produce a minimum yearly average run-off, based on years 1926 and 1927, of 12 M. G. D. This discharge would be in addition to the Pink Beds area. With a 24" pipe line, and without an impounding dam, delivering to an elevation of 2300 near Asheville, the delivery would be, with a 290 ft. head, 7.5 M. G. D. or 13 M. G. D. through a 30-inch pipe line, subject to minimum fluctuations. Building a dam 130 feet in height would impound approximately 2.3 billion gallons, which could be used as a high pressure supply, the constant delivery being, with a 185 ft. head, 15 M. G. D. through a 36-inch pipe.

A FIFTH UNIT can be developed below the mouth of Bradley Creek, which will be a low pressure system only. With all other units in operation there would remain an additional 6.3 miles of drainage plus the surplus from Bradley Creek, which, with a suitable impounding reservoir, will deliver into Asheville at the elevation of 2300 with a head of 100 ft., 15 M. G. D. through a 36-inch pipe line.

We submit the following estimates of cost:

SECTION NO. 1.

Station 0+00 to 600+00—Distribution Line

Frady Mt. Reservoir to City of Asheville.

All trenching and excavation for pipe line, including clearing and grubbing and backfilling of trenches -----	\$ 66,287.35
Furnishing all material and laying complete in place the following items:	
Cast Iron pipe -----	489,002.90
Cast Iron pipe specials -----	5,697.00
Valves -----	7,225.00
Miscellaneous masonry structures on pipe line (including manholes, valve vaults, concrete in trenches and piers and reinforcing steel) -----	14,581.50
	\$582,793.75
Engineering and contingencies -----	46,623.50
Total -----	\$629,417.25

SECTION NO. 2

FRADY MOUNTAIN RESERVOIR.

All excavation unclassified in connection with Reservoir and Gate Houses -----	\$ 48,000.00
All concrete in Reservoir and Gate Houses -----	117,565.00
Furnishing and placing reinforcing and structural steel, and other miscellaneous iron, including stairs in Gate Houses -----	60,120.50
Furnishing all cast iron pipe and fittings and laying complete in place -----	23,834.36
Furnishing all valves and venturi meter and installing complete in place -----	12,554.00
Furnishing and laying complete all terra cotta and concrete drain pipe -----	4,771.60
Furnishing and erecting fencing and constructing sidewalks around reservoir -----	4,047.25
Furnishing all material and installing complete electric lights around Reservoir and in Gate Houses -----	1,200.00
Building complete roadway leading to Reservoir -----	6,650.00
	\$278,742.71
Engineering and contingencies -----	22,299.42
Total -----	\$301,042.13

IMPOUNDING RESERVOIR

AREA: 1210 ACRES

15.37 BILLION GALLONS

EL. W.S.: 3260



SECTION 2-A
PRESSURE REGULATING RESERVOIR
On
DEAVER VIEW MOUNTAIN

All excavation unclassified in connection with reservoir	\$ 12,800.00
All concrete in reservoir	53,467.50
Furnishing and placing reinforcing steel	28,767.00
Furnishing all cast iron pipe and fittings and laying complete in place	2,691.00
Furnishing all valves and installing complete in place	2,536.00
Furnishing and laying complete all terra cotta drains	799.00
	\$101,060.50
Engineering and contingencies	8,084.84
Total	\$109,145.34

SECTION NO. 3.

Station 0+00 to 440+00, Intake Main.

All trenching and excavation for pipe line, including clearing and grubbing and backfilling of trenches	\$ 45,539.40
Furnishing all material and laying complete in place the following items:	
Cast Iron pipe	585,815.90
Cast iron pipe specials	8,689.05
Valves	5,435.00
Miscellaneous masonry structures on pipe line (including manholes, valve vaults and concrete in trench and piers)	14,357.50
	\$659,836.85
Engineering and contingencies	52,786.95
Total	\$712,623.80

SECTION NO. 4.

Station 440+00 to 792+00—Intake Main.

All trenching and excavation for pipe line, including clearing and grubbing and backfilling of trenches	\$ 54,170.30
Furnishing all material and laying complete in place the following items:	
Cast Iron pipe	453,734.00
Cast Iron pipe specials	21,471.20
Valves	5,365.00
Miscellaneous masonry structures on pipe line (including manholes, valve vaults and concrete in pipe trenches)	6,450.00
	\$541,190.50
Engineering and contingencies	43,295.24
Total	\$584,485.74

SECTION NO. 5.

Intake, Tunnel and 42" Main

INTAKE—

All excavation unclassified for dam and other structures at intake -----	\$ 3,575.00
All Concrete at intake dam-----	26,362.50
Furnishing and placing reinforcing and structural steel and other miscellaneous iron-----	2,642.00
Furnishing all valves, venturi meter and sluice gates -----	8,672.00
Furnishing and installing power unit and lighting system -----	3,616.00
Clearing and grubbing intake reservoir-----	712.50

Cost of Intake ----- \$45,580.00

TUNNEL—

All excavation unclassified -----	\$24,540.00
Concrete -----	3,665.00
Furnishing and placing reinforcing and structural steel and timbering-----	1,261.00
Furnishing and laying complete in place all cast iron pipe, specials and valves	27,695.20
Lighting system -----	1,000.00

Cost of tunnel ----- 58,161.20

42-INCH MAIN

All trenching and excavation for pipe line, including clearing and grubbing and backfilling of trenches-----	\$12,156.09
Furnishing all material and laying complete in place the following items:	
Cast iron pipe -----	21,600.00
Cast iron pipe specials-----	1,104.00
Miscellaneous masonry structures on pipe line (including concrete in pipe trench and piers) -----	6,755.70

Cost of 42-Inch Main----- 41,615.79

Section No. 5 ----- \$145,356.99

Engineering and contingencies ----- 11,628.56

Total ----- \$156,985.55

SECTION NO. 6

Impounding Dam.

All excavation unclassified in connection with dam and spillway -----	\$134,007.40
All concrete in connection with dam-----	1,047,068.50
Furnishing and placing reinforcing and structural steel, and other miscellaneous iron-----	7,195.95
Furnishing and placing cast iron pipe-----	15,670.50
Furnishing and placing gate valves, sluice gates, stairs, etc. -----	9,643.50
Superstructure of power house and outlet gate house -----	3,000.00
Power unit, transmission line and lights-----	7,175.00
Highway guard rail and drain pipes-----	1,566.00

\$1,225,326.85

Engineering and contingencies ----- 98,026.15

Total----- \$1,323,353.00

SECTION NO. 7.

Impounding Reservoir.

For furnishing all labor, tools, machinery and material necessary for clearing and grubbing	\$175,000.00
Engineering and contingencies	14,000.00
Total	\$189,000.00

SECTION NO. 8.

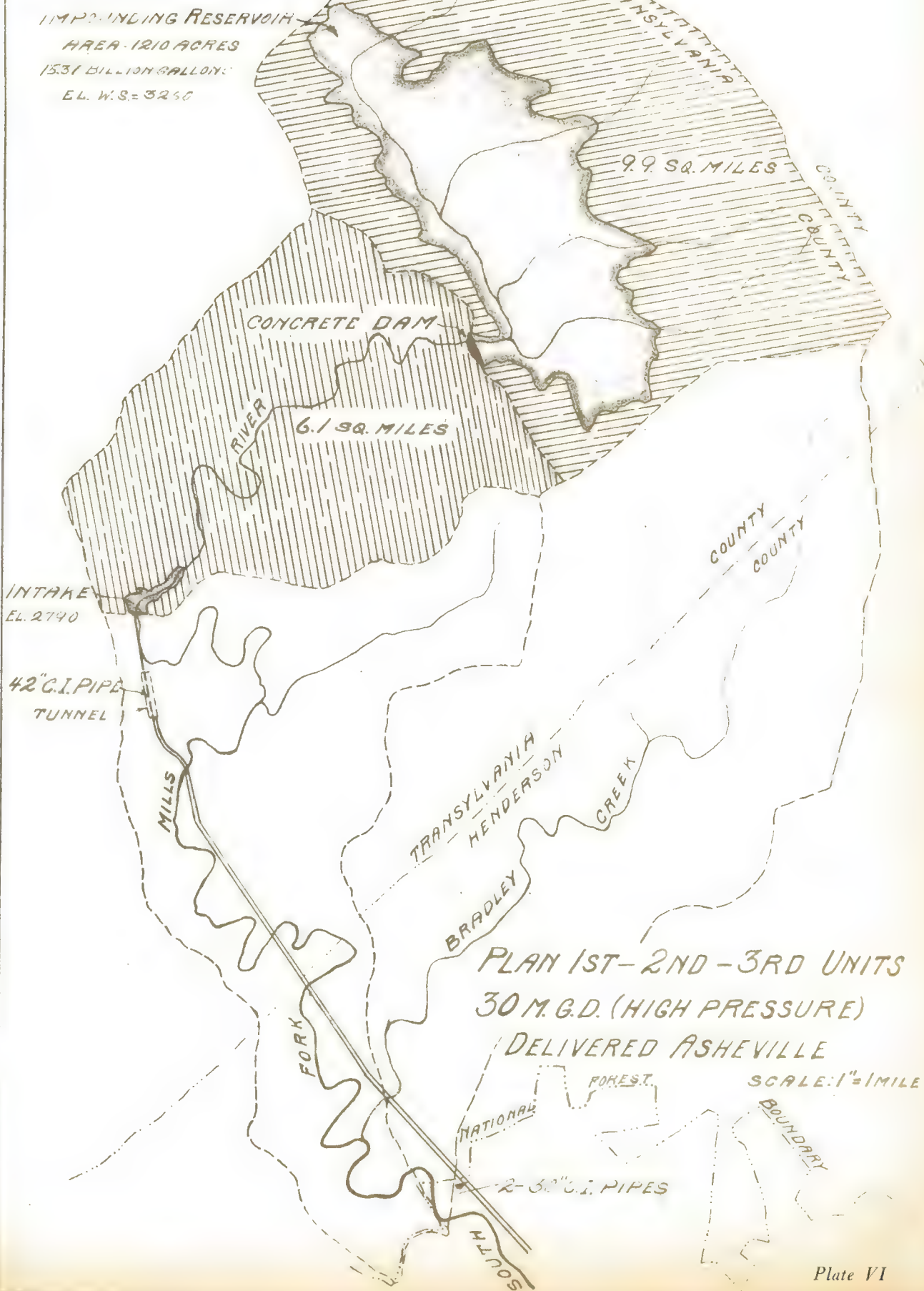
Pink Beds Roadway.

All excavation unclassified in roadway and drainage structures	\$16,200.00
All concrete and rubble masonry in drainage structures	13,062.00
For furnishing and installing complete corrugated metal culverts	5,351.20
Engineering and contingencies	2,769.05
Total	\$37,382.25

The cost of the third unit will probably be a duplication of sections 3 and 4 of the first unit which is \$1,297,000.00.

Cost of the fourth and fifth units will not be discussed at this time.

<i>Intake and Tunnel</i>	<i>Pipe Lines</i>	<i>Distribu- tion Reservoir</i>	<i>Distribu- tion Lines</i>	<i>Dam and Impound- ing Reservoir</i>	<i>Total Cost</i>	<i>Total M.G.D.</i>	<i>Cost per M.G.D.</i>
\$156,985.55	1—30" line \$1,297,109.54	\$301,042.13	\$		\$1,755,137.22	13.4	\$131,000.00
156,985.55	1—30" line 1,297,109.54	301,042.13	1—24" line 27,000 ft. to Asheville \$270,000.00		2,025,137.22	13.4	151,100.00 (3)
156,985.55	1—30" line 1,297,109.54	301,042.13	1—24" line 60,000 ft. to Deaver View & 5 M. G. Res. \$738,562.59		2,493,699.81	13.4	186,100.00
156,985.55	1—30" line 1,297,109.54	301,042.13	-----	\$1,549,735.25	3,304,872.47	15.0	220,300.00
156,985.55	1—30" line 1,297,109.54	301,042.13	1—24" line 60,000 ft. to Deaver View and 5 M. G. Res. \$738,562.59	1,549,735.25	4,043,435.06	15.0	269,600.00
156,985.55	1—30" line 1,297,109.54	301,042.13	1—24" line 27,000 ft. to Asheville \$270,000.00	1,549,735.25	3,574,872.47	15.0	238,300.00 (1)
156,985.55	2—30" line 2,594,219.08	301.042.13	-----	1,549,735.25	4,601,982.01	30.0	153,400.00
156,985.55	2—30" line 2,594,219.08	301.042.13	1—24" line 1—20" line 27,000 ft. to Asheville \$472,500.00	1,549,735.25	5,074,482.01	30.0	169,100.00 (2)
156,985.55	2—30" line 2,594,219.08	301.042.13	1—24" line 60,000 ft. to Deaver View & 5 M.G. Res. 1—20" line 27,000 ft. to Asheville \$941,062.59	1,549,735.25	5,543,044.60	30.0	184,800.00



NOTE: Totals marked (1) (2) and (3) are for supplying the water to the Asheville mains and are comparative to the systems now in use and those suggested in previous reports, in that they would all have the same point of delivery, namely Asheville, but totals (1), (2) and (3) have a lower cost with a larger delivery in gallons per day.

Cost of first unit is \$1,755,137.22 without distribution line. We show the cost in this manner which permits of a comparison of costs shown in other reports that do not include cost of distribution system.

Area above Pink Beds gauging station, 9.87 sq. mi.; area between Pink Beds gauging station and the intake $4\frac{1}{2}$ mi. below=6.04 sq. mi., or 61.2% of the area above the Pink Beds gauging station. From J. L. Ludlows report, during the period covered by the parallel records, the average flow at the Sitton Gauging Station was 1.42 M. G. D. per sq. mi., and at the Pink Beds Gauging Station was 1.93 M. G. D. per sq. mi. Assuming that the runoff per sq. mi. increases at a uniform rate as the stream is ascended then the runoff at the proposed intake will be $(17.50 \div 12.8) .51 + 1.42 = 1.79$ M. G. D. per sq. mi. The total runoff at the proposed intake will have an increase over the total Pink Beds runoff of 57.1%. In the same manner the Cantrell Creek intake site has a total increase in runoff over the Pink Beds runoff of 76.9%, and Bradley Creek Intake site, exclusive of Bradley Creek, 121.1%.

Table of minimum weekly runoff at Pink Beds gauging station and at intake:

July 16 to July 22, incl., 1926.

1. P. B. Gauging Station			2. 57.1% of 1st Column		3. At Intake	
July	c. f. s.	Million gals. per day	Million gals. per day		Million gals. per day Columns 1 and 2	
16	4.8	3.11	1.77		4.88	
17	4.5	2.92	1.67		4.59	
18	4.5	2.92	1.67		4.59	
19	4.1	2.65	1.51		4.16	
20	3.8	2.46	1.405		3.865	
21	3.5	2.27	1.295		3.565	
22	3.8	2.46	1.405		3.865	
Total	29.00	18.79	10.725		29.515	

18.79 M. G. for the week=2.7 M.G.D. runoff at the Pink Beds gauging station.

29.515 M. G. for the week=4.2 M.G.D. runoff at the intake.

Using the weekly minimum of July, 1926, which is the lowest since 1896, from calculated records available, and undoubtedly the lowest runoff in the last 32 years, we would have a minimum at the intake of $2.7 + (57.1\% \text{ of } 2.7) = 4.2$ M. G. D. Since this condition occurs only at such rare intervals and since the same condition existed on other watersheds of this region at the same time, we believe any consideration of this quantity as a minimum would not be the part of wisdom, and would give a figure far below the actual quantity really obtained during 99.9% of the entire interval of time.

MILLS RIVER RUNOFF—MILLIONS OF GALLONS
MEASURED QUANTITIES

Month	Calculated Quantities 1925	1926		1927		1928	
	Pink Beds	Pink Beds	Intake	Pink Beds	Intake	Pink Beds	Intake
January	1247	1067	1676	541	849	683	1073
February	738	981	1541	495	776	474	744
March	679	686	1077	840	1319	576	903
April	501	731	1147	436	685	901	1416
May	389	364	570	313	491	1000	1571
June	284	216	338	333	523		
July	221	267	419	283	445		
August	130	327	512	403	632		
September	181	180	283	162	254		
October	183	179	280	229	360		
November	386	620	974	360	566		
December	289	723	1135	1048	1646		
Totals	5228	6341	9952	5443	8546	3634	5707

The runoff at the Pink Beds gauging station during the year 1926 was 6,341,000,000 gallons. The gauge was installed in February of 1926 and the record begins February 25, 1926. The quantities for January and the 24 days in February were taken from J. L. Ludlow's calculated amounts. The runoff for 1927 was 5,443,000,000 gallons.

The runoff at the Pink Beds gauging station for the driest month of the year 1927, the year showing the smallest measured runoff, was 162 M. G. for the month of September, or 5,400,000 gallons per day, actual measurement. The calculated runoff for 1925 was 5,228,000,000 gallons. The 1927 figure is used as it is a measured quantity. At the intake we would have 5,400,000 gallons + 57.1% or 8,480,000 gallons per day. Even this minimum flow occurs only one month in 384, or for a duration of .26 of one percent of the time, during the thirty-two years.

From January 1, 1928, to May 28, 1928, the runoff at the Pink Beds gauging station was 3,634,000,000 gallons or 24 M. G. D., which indicates that the peak of the drought has passed and runoff is returning to normal. The mass curve for 1928 indicates an increase in runoff over 1927. The quantities compiled by J. L. Ludlow give a runoff at the gauging station of 343,031,770,000 gallons for 30 years, or an average of 11,434,000,000 gallons per year from 1896 to 1925 inclusive. Including the years 1926 and 1927, the average yearly runoff for the 32 years is 11,086,000,000 gallons or 30 M. G. D. The 1927 runoff at the gauging station being 5,443,000,000 gallons is 49.1% of the average runoff for 32 years or less than half. The 1927 runoff gives 14.91 M. G. D. at the Pink Beds dam or $14.91 + (57.1\% \text{ of } 14.91) = 14.91 + 8.51 = 23.42$ M. G. D. at the intake.



The quantity of water passing through the 30 inch pipe line during 1927, had it been in operation, would have been as follows:

<i>Year 1927</i>	<i>Gallons Delivered</i>
January -----	465,000,000
February -----	420,000,000
March -----	465,000,000
April -----	450,000,000
May -----	436,700,000
June -----	433,300,000
July -----	395,000,000
August -----	406,700,000
September -----	254,000,000
October -----	317,100,000
November -----	366,200,00
December -----	465,000,000
Total -----	4,874,000,000
13,400,000 G. per day.	

Each million gallons brought in last year would have cost \$1,755,137.22 divided by 13.4= \$131,000.00. Including the distribution system from Frady Mountain to Asheville, the total cost would have been \$2,025,137 or \$151,100.00 per M. G. for last year's total quantity. Including the distribution system to Deaver View Mt., the total cost would have been \$2,493,699.81 or \$186,100.00 per M. G. for last year's total quantity.

After the completion of the dam, there will be sufficient storage to provide for the maximum capacity of the pipe line. The cost of the first and second units or the cost of the impounding dam and one 30" pipe line to Frady Mountain, including the reservoir at that place, will be \$3,304,872.47 or \$220,300.00 per M. G. for a 15 M. G. D. supply. The cost of the first and second units, as stated above, including the Frady Mountain reservoir, and in addition the 24" distribution line to Asheville, will cost \$3,574,872.47 or \$238,300.00 per M. G. for a 15 M. G. D. supply.

The 24" distribution line from Frady Mountain to Asheville will deliver at the South city limits of Asheville a maximum of 20 M. G. D. The 20" connection into Choctaw will deliver a maximum of 16 M. G. D. The 24" line into Haywood Road at State Street will deliver a maximum of 12 M. G. D. The 24" line will deliver into the Deaver View reservoir a maximum of 4.7 M. G. D.

The cost of first, second and third units, or the impounding dam, with 2-30" pipe lines from intake to Frady Mountain reservoir, including cost of reservoir, will be \$4,601,982.01, supplying 30 M. G. D. or \$153,400.00 per M. G. The cost, as stated above, plus distribution lines to Asheville, will be \$5,074,482.01, supplying 30 M. G. D. or \$169,100.00 per M. G.

The cost of first, second and third units, including 24" distribution line to Deaver View reservoir and the reservoir, also 20" distribution line to Asheville, will cost \$5,543,044.60, providing 30 M. G. D. or \$184,800.00 per M. G.

The population of the City of Asheville as given by the Asheville City Directory for 1928 is stated as being more than 47,000, and the population of Greater Asheville area is given as 70,000, the latter figure including Asheville and suburbs, or that particular area in and around Asheville which will be in the City limits within a time not far distant, and as such, must be provided with sufficient water to meet their needs. Any supply system which does not provide for sufficient water to embrace the needs of this area should not be considered.

It is quite true that any growing city must not only have a sufficient water supply to meet its present demands, but must also be able to make immediate increased delivery to those industries and other users which may desire to obtain additional quantities of water. While Asheville was formerly a tourist

city, it is now, and has been for some time past, a location favored by larger industries as sites for additional industrial plants, largely because of the excellent quality of the water, desirable climatic and labor conditions. It is also true that during the past two or three years some of these industrial plants which desired to locate here have gone elsewhere because the City found it impossible to guarantee them water in quantities sufficient for their purposes. The present City supply is obtained from the North Fork and Bee Tree water sheds and comes into the City through a 16-inch cast iron main from North Fork and 24-inch and 16-inch cast iron mains from Bee Tree. The two 16-inch mains will deliver about six and one half million gallons per day when running full, and the new 24-inch main could deliver about nine and one half million gallons per day if running full. The Bee Tree water shed area, however, will not supply continuously more than seven million gallons per day, (see report 112, page 39) and could not have supplied that amount continuously through the dry period of 1925, 1926 and 1927. The average continuous supply from the North Fork and Bee Tree areas with the present facilities is about eleven million gallons. During the dry season of each year the quantity obtained from these two sources would not be more than eight million gallons per day, which is the supply received during the time when the demand is the largest. To obtain additional quantities from the North Fork area will require the construction of an impounding dam and additional pipe lines. During the dry periods of the past seasons Asheville has consumed from ten to eleven million gallons of water per day, or the supply was barely sufficient to meet the demand. Because of the construction of several sanitary districts the demand soon will be much greater than it was at that time, and the present output of the North Fork water shed will be entirely consumed in the valley through which it runs, leaving the Bee Tree supply only from which the City must get all its water. The amounts of water consumed per capita per day varies to a great extent in different cities and exceeds two hundred gallons per capita per day in several cities in the United States. From the records of the Water Department of the City of Asheville we find that this city uses more than two hundred gallons per capita per day during periods of maximum demand. It would seem highly advisable to provide for this amount per capita, which will give the maximum demand of fourteen million gallons per day for the present population of Asheville and suburbs of 70,000. This neither provides for an increase in population nor for additional consumption by industrial plants. Then further, with the completion of the present sanitary districts under construction the available supply remaining to be utilized by the City of Asheville will have shrunk to a continuous daily supply of not more than seven million gallons.

The Forestry Department of the United States Government sent its engineer, Mr. J. C. Dort, to Asheville in 1927 and he went over the Bee Tree, North Fork and Pink Beds areas with the idea of making investigations for the purpose of submitting recommendations to the Department of Agriculture relative to the needs of the City of Asheville with reference to the development of sources of water supply. With all information before the Department of Agriculture, including all affidavits of engineers filed in case of Hall et al vs City of Asheville et al, the same being a matter of record, and on file for public inspection in the City Hall of the City of Asheville, the United States through its engineers and its Chief of Department in the Forest and Agriculture Service, find as a fact that the City of Asheville needs the development of that source of water supply known as the South Fork of Mills River, or the Pink Beds area. Nothing has been more fully discussed than the need of an adequate water supply for the City of Asheville. The entire story is a matter of record, both as to our mistakes and the remedy. Asheville has suffered three acute water shortages in the past six years. The water record on file, and available for inspection, shows that the City of Asheville on the 20th day of January, 1927, filed a formal application with the Forestry Department of the U. S. Government for the use of the Pink Beds of the South Mills River watershed as a source of water supply. A supplemental formal application was filed on the 11th day of February. A formal hearing was had on the 11th day of February, 1927. The town of Hendersonville vigorously contested the application for this source of water supply by the City of Asheville. After a full and complete hearing the Forester, and on appeal the Chief Forester, and again on appeal the Secretary of Agriculture, found as a fact that the City of Asheville was in need of this source of supply. Col. J. L. Ludlow, at a cost of \$32,500.00, made an extensive and exhaustive survey and findings of fact as to the relative merits of the North Fork and the Pink Beds as sources of water supply. Col. Ludlow found that the Pink Beds



was a more abundant source and a cheaper source of development than the North Fork. The report of Col. Ludlow, the formal application of the City for this source, the reports of investigations of all other engineers employed by the City of Asheville have been given great publicity by both newspapers in the City. There is no question that has ever been before the people of Asheville that has been given as much publicity. Very little is left to be said relative to the water supply of the City of Asheville and its immediate needs that has not already been said. The results of the exhaustive researches are a matter of record. The City of Asheville, by formal resolution, deemed that it was wise and advisable to secure the Pink Beds. This resolution was given wide publicity. The City of Asheville, in its formal application for a permit from the Department of Agriculture to develop the Pink Beds, made a detailed statement of its plan of development. This detailed statement was given wide publicity. After the people of Asheville had fully made up their minds as to the necessity and wisdom of developing this unique and abundant source of water supply, the present City administration took the matter of the development of the Pink Beds under advisement and made a complete and thorough investigation of the needs of the City of Asheville for an increased water supply and the possible sources for this increase. After deliberating for four months, the governing body of the City of Asheville concluded, with all the facts before it, that the Pink Beds should be developed and should be developed as set out in the application of the City for water rights to the Forest Service of the Department of Agriculture. The City, in order to secure a permit to develop this source of supply, found that it was necessary to gather exact engineering data as to the cost of development, the location of lines, the proposed impounding dam, the intake, and the character of the impounding structure, together with size of the cast iron mains. This work was let by contract to the Howerton Engineering Company of the City of Asheville.

The Asheville Citizen, under date of October 30, 1927, carried a large photograph of the proposed impounding reservoir in the Pink Beds, together with a front page news story, and on October 31, 1927, a comprehensive editorial endorsing and complimenting the governing body of the City of Asheville in undertaking to develop this source of water supply. A similar editorial appeared in the Asheville Times on the same day.

On pages 99 and 100 of Report 112, Mr. John R. Freeman has this to say with reference to the development of the Burnett site on the North Fork of the Swannanoa:

"Unfortunately, for present needs, I find the elevation of this Burnett reservoir site is such that it could not be made available without a new pipe line. Whenever the time comes, perhaps 10 years or more hence, for a new pipe line from the water-sheds, this new pipe line could follow more nearly the course of the Swannanoa River and give a gravity delivery to the low-service district of Asheville.

"At present it cannot be made available thru the present pipe lines because of these having been run part of the way at much higher elevation than this reservoir site, across lots, over hills and hollows, in the effort to obtain the straightest possible course between the respective intakes and the reservoirs at Beau-catcher Gap.

"A reservoir at this Sherrill-Burnett site would be about 13 miles distant, by Pipe line, from the City and its flow line could advantageously be placed at elevation 2550, or, in the early stages, at 2525. The lowest limit of draft could advantageously be placed at elevation 2500. This would give 200 feet of head for delivery into the proposed low-service zone of Asheville, which is ample to enable a pipe 24 inches in diameter to carry 7 million gallons per 24 hours to the City, even after it has become old and encrusted with deposits. This reservoir, with dam flow line at 2525, would probably supply double that quantity."

From the foregoing you will see that the Burnett site is practical for low pressure service only.

The North Fork land has been acquired, and it together with the Burnett site will become available at some future date when it is advisable to complete an outfall down the Swannanoa river into the industrial community of the City of Asheville, provided the proposed dam site proves upon investigation by core drilling and otherwise to be safe and suitable for the construction of an impounding reservoir.

In passing, let us say that it may be well to recur to the record. All information to date can be had at the City Hall. An inspection of the records shows that the average daily runoff per sq. mile for the Pink Beds, from Jan. 1st, 1926 to June 1st, 1928 was 1.77 M. G. and for the North Fork 1.41 M. G. D.

per square mile during the same period, or 25% more runoff per day per square mile is obtained in the Pink Beds area for the entire period of two and one-half years. The North Fork at the Burnett site is what Mr. J. R. Freeman and other engineers are pelased to call a low pressure proposition. Mr. Freeman says that the water from the Burnett site will not come to the Beaucatcher reservoir through the present lines for the reason that there are many hills between the source of supply and distribution that are higher than the source of supply. This would necessitate, as he says, the building of a pipe line following the course of the Swannanoa River into the lower levels of the City. We all know, however, that by building a dam high enough and wasting a forty or fifty foot head, it would be possible to get a limited amount of water from a storage reservoir on the North Fork into the present reservoir on Beaucatcher. This would be impractical as the storage obtained would only be eight billion gallons from a dam 155 ft. high above stream bed and 1400 ft. long, in comparison to fifteen billion gallons storage from a dam 127 ft. high, above stream bed and 720 ft. long, at the Pink Beds development. According to Col. Ludlow, the maximum development of the North Fork would take a dam 155 ft. high above present stream bed, and 1400 ft. long, creating a reservoir of 459 acres in area, containing approximately eight billion gallons when full, making a supply of twenty-four and three-tenths million gallons daily, including the present diversion through the 16" main at North Fork intake. The cost of the dam alone would be approximately \$2,700,000.00, and the complete cost of installation, including dams, pipe lines, etc., would exceed \$5,000,000.00. Add this amount to what has already been spent on the Bee Tree development (\$2,159,000) then figure the total against the amount of water produced and arrive at your own figures. The proposed Pink Beds development is a high pressure source of supply. The water delivered to the City from this source will flow by gravity into your present reservoirs and into other reservoirs of even higher elevation. The South Mills River watershed is capable of delivering, when developed to its utmost capacity, twice as much water to Asheville as North Fork and Bee Tree combined. If it is possible to develop the North Fork watershed to a maximum of 24 million gallons per day, it is much more feasible to develop the South Mills River watershed to a maximum of 60 million gallons per day, 45 million gallons of which is high pressure and 15 million gallons low pressure, exclusive of Bradley Creek.

COSTS FROM CITY RECORDS

Bee Tree Dam

Real Estate -----	\$ 22,876.82	
Dempster Construction Co. -----	708,407.03	
Payrolls -----	67,649.37	
Chas. E. Waddell -----	92,214.59	
Miscellaneous -----	203,965.90	
		\$1,095,113.71

Bee Tree Pipe Line

Kelly & Wilson Co. -----	\$745,466.87	
Chas. E. Waddell -----	41,382.62	
		786,849.49

White Fawn Reservoir

Tucker & Laxton -----	\$197,099.08	
Chas. E. Waddell -----	16,800.68	
Miscellaneous -----	1,405.32	
Grouting Cost -----	27,355.08	
		242,660.16

Miscellaneous Payments to Chas. E. Waddell

Filter Plant -----	\$ 10,188.96	
North Fork Pumping Station -----	2,500.00	
Emergency Supply -----	1,805.71	
North Fork Dam -----	19,895.00	
		34,389.67

Total ----- \$2,159,013.03

PROPOSED IMPOUNDING DAM
FOR
ASHEVILLE-WATER SUPPLY
FROM
PISGAH NATIONAL FOREST

July 1900.
Plate IX



Designed by Frank B. Cook
Engineer, Asheville, N.C.

APPLICATION OF THE CITY OF ASHEVILLE TO THE DEPARTMENT OF
AGRICULTURE:

L-Uses-Pisgah.

City of Asheville—Watershed.

HON. EVAN W. KELLEY,
District Forester,
Eastern District,
Forest Service,
U. S. Dept. of Agriculture,
Washington, D. C.

Dear Sir:

The City of Asheville, North Carolina, hereby makes formal application for the use of the water supply afforded by what is known as the Pink Bed area in the Pisgah National Forest, embracing the entire watershed of the South Fork of Mills River except so much thereof as drains into Bradley Creek.

In support of said application the City of Asheville hereby respectfully submits in reply to your communication of January 18, 1927, the following statement of facts:

I.

The City of Asheville is now supplied with water by a 16-inch cast-iron main, 10 miles in length, to the Bee Tree watershed, connecting said watershed with the 250,000-gallon cast-iron stand pipe and the 5,000,000-gallon concrete reservoir situated on Beaucatcher or Town Mountain, and also a 16-inch cast-iron line to the North Fork of the Swannanoa River water shed, connecting with the same stand pipe and reservoir.

These two 16-inch mains, theoretically, furnish the City of Asheville approximately six and a half million gallons of water per 24-hour day. Both lines are gravity lines. The pumping station is situated on the North Fork of the Swannanoa River below the intake which theoretically supplies approximately two million gallons of water per day.

The City of Asheville is just completing an impounding reservoir on the Bee Tree watershed about a thousand feet below the present intake at a cost of approximately one million dollars. The capacity of this storage reservoir is computed to be six hundred and fifty million gallons.

A contract has been let for a 24-inch cast-iron main connecting this impounding reservoir with the distribution reservoir and stand pipe before mentioned and the same is in the course of construction.

In order to augment the storage facilities near the City's distribution mains, the City is now completing the construction of an eleven million gallon storage reservoir at White Fawn Gap at the same elevation as that of the present storage standpipe and five million gallon reservoir, to which this 24-inch main will be connected in a very short time.

It is estimated that the Bee Tree impounding reservoir and run-off will supply the City with seven million gallons of water per day and that the North Fork line will supply, by gravity, three million gallons of water per day and, by pumping, two additional million gallons per day, making a total of twelve million gallons of water per day.

As an additional source of supply the City of Asheville has established a pumping station and filtering plant on the French Broad River near what is known as the Biltmore House, which supplies the City, by pumping, two and one-half million gallons of water per day from this source.

The pumping station on the North Fork of the Swannanoa River and the pumping station and filtering plant on the bank of the French Broad River, furnishing four and a half million gallons of water per day, are nothing but temporary make-shifts to provide against such a time as the City can supply or provide an adequate pure source of water supply.

The City of Asheville contemplates the purchase of an additional area on the North Fork of the Swannanoa River watershed in the furtherance of its plan of development. The Engineer states that the

complete development, which entails the construction of an impounding reservoir on the North Fork of the Swannanoa River, will furnish, including the Bee Tree storage reservoir, thirty million gallons of water per day; that is to say, the maximum supply of water that could ever be hoped for from this source of supply, namely the Bee Tree and North Fork watersheds, would be thirty million gallons of water, and before this could be made available the City would have to go through a waiting period of approximately three years, pending the construction of this impounding reservoir on North Fork.

The filling of the reservoir after it is constructed would, of course, depend upon an excess of rain-fall amounting to a sufficient quantity to fill the reservoir over and above filling the gravity main or mains attached to the reservoir which might easily require a period of a year or more. So that, a minimum period of three years might be anticipated before any substantially increased supply could be obtained from the North Fork, as this storage reservoir, as planned, is computed to contain two and a quarter billion gallons of water.

Assuming that the Bee Tree and North Fork of the Swannanoa watersheds are capable of yielding thirty million gallons of water per day, then, according to the most competent authority upon this subject, this would not be a sufficient water supply for domestic and fire purposes only, for a population of 150,000 people.

For your convenience and information we quote from the International Library of Technology, Sewerage and Irrigation, 1908 Edition, page 70, figures as follows:

"Water required for domestic and fire purposes for population up to 200,000:

"Population, 60,000; 14,192,640 gallons.

"Population, 150,000; 30,493,440 gallons.

"Population, 200,000; 39,445,920 gallons."

You will note that these figures are based solely upon uses for domestic and fire purposes and it does not take into consideration any of the more modern uses, such as trucks, automobiles, the washing of automobiles, and the rapidly growing industrial uses.

We also especially call your attention to the fact that the estimate of all Engineers employed by the City of Asheville has based consumption solely upon a per capita of one hundred gallons per day.

To quote from the same authority, at page 68, we wish to especially call your attention to the fact that at the date of this publication, Alleghany, Pennsylvania, consumed two hundred and forty-seven gallons per capita; Buffalo, New York, 271 gallons per capita; Camden, New Jersey, 200 gallons per capita; Charleston, South Carolina, 27 gallons per capita; Chicago, Illinois, 109 gallons per capita; Cleveland, Ohio, 142 gallons per capita; Fall River, Massachusetts, 43 gallons per capita; Washington, D. C., 200 gallons per capita; Philadelphia, Pennsylvania, 215 gallons per capita; and Yonkers, New York, 200 gallons per capita; clearly indicating the fallacy of an attempt to fix the per capita basis of consumption, due to the fact that a fixed basis affords no difference in scale for towns and cities of different type and character, in that large and growing industrial towns as well as resort towns consume many times more water per capita than towns that have been entirely completed or what might be termed towns that are stunted in growth or have stopped growing or that have such a repulsive source of water supply that people refuse to consume it.

It is perhaps pertinent to observe in this connection that upon a survey of water consumption in Asheville made by a very distinguished engineer in 1922 it was found that the consumption was somewhat more than two hundred and eighty gallons per capita, thus indicating that Asheville is the type of town which requires a water supply of generous quantity.

We also deem it pertinent to call it to your attention that Asheville is today consuming three times as much water as it was consuming in 1920, and the conditions are apparent which indicate an equally rapid increase for some time to come.

We mention the rapid increase in the water consumption at the Government Hospital at Oteen through their 8-inch connection; the 8-inch connection to the Sayles Finishing Plant, which is only now



The Pink Beds Dam Site—Looking Up Stream—Location of Dam Shown by Dotted Line.

coming into use; and the insistent demand for at least an 8-inch connection at the village of Swannanoa for the service both of the village and the new manufacturing plant there.

To thoroughly understand the immediate needs for more water for the City of Asheville we think it well to say that in addition to the three sources of distribution just mentioned that the City of Asheville furnishes a large industrial area just outside of the City limits and, in addition to these, furnishes the incorporated towns of Kenilworth, Biltmore, and South Biltmore, and a fast-growing area around these incorporated towns to the south of the City, and, to the north of the City, furnishes all of that area known as Beaver Lake or Lake View, Grace, Norwood, the Country Club, and Grove Park Inn, all of which are outside of the present City limits of the City of Asheville. In short, the present water consumption outside of the City limits of the City of Asheville and furnished by the City of Asheville is equal to the consumption within the City limits. Our last census or survey disclosed that we were furnishing water to more than sixty thousand people and, in addition, to a widely extended and rapidly growing industrial area.

In other words, we have developed our own present sources of water supply to the utmost possible for the present and still we have a shortage of water.

Our experience proves the statement of the authority quoted, that sixty thousand people will consume more than fourteen millions of gallons of water per 24-hour day.

We can not possibly relieve this condition inside of three years as stated, unless we can secure the run-off from an additional source of water supply adequate to take care of the City and its consumers until we can have sufficient time to supply an ever-growing demand by storage or impounding.

To give you an idea of the imperative necessity of immediate action in securing the Pink Bed sources, you are respectfully advised that the County of Buncombe is embraced in a public local law which authorizes the creation of water and sanitary sewer districts throughout the County upon the petition of a majority of the qualified voters of the proposed districts.

Under this law the South Biltmore Sewer District, covering a large area, has been installed; the Woodfin District has been completed and is in operation; the Fairview District, covering a large populous area, is in the course of construction; the Caney Valley Sewer District has been created and is in course of construction; the Beaver Dam Water and Sewer District has been created; and the Swannanoa Sanitary District is under survey and will be established in a very short time.

The Swannanoa District embraces the entire Swannanoa Valley from Montreat and Ridge Crest to the Asheville City limits, including all of Haw Creek, Swannanoa, and a large part of Biltmore.

This large sanitary sewer project will involve an expenditure of more than a million dollars and the main outfall will be taken over by the City of Asheville at its limits and the entire discharge conveyed below the City of Asheville and ultimately discharged into the French Broad River.

The successful operation of this sewer is dependent upon an adequate water supply. It is a necessity due to the rapid industrial growth, the towns situated in the valley, the large residential developments, and Oteen Hospital. The people in the district not only want the district created but they are demanding it.

Thus you will readily see that the three million gallons of water furnished by the 16-inch main at present from the North Fork watershed ought to, and as a matter of fact should, be entirely consumed by the people of the valley through which it passes before it ever reaches the City of Asheville.

As a matter of information, in connection with our statement that Oteen was connected with this main by an 8-inch tap, we wish to further call your attention to the fact that this is the only source of water supply for the Government Hospital at Oteen; that the Government Hospital at Oteen took through its 8-inch connection with Asheville's supply system in the month of January, 1926, six million gallons of water, and in December, 1926, eight million gallons of water, and its present consumption is at the average rate of two hundred fifty thousand gallons per day, which naturally will be greatly increased in connection with the carrying out of the program already authorized by Act of Congress for permanent constructions and the enlargement of said Hospital.

To verify these figures we respectfully call your attention to a telegram under date of January 19, 1927, reading as follows:

"J. Walter Haynes,
"Care Sir Walter Raleigh Hotel,
"Washington, D. C.

"Oteen line eight inches direct connection our sixteen inch main stop no other source of supply stop
January twenty-six consumed six million gallons December twenty six eight million stop daily average
about two hundred fifty thousand gallons. "Cathey."

This telegram was signed by the Mayor of Asheville, John H. Cathey, and is hereto attached for your inspection, marked "City of Asheville Exhibit A."

During the year 1926 what is known as the South Buncombe Water District was created from Biltmore along the Hendersonville road, including in its boundaries a large area and involving construction costs of two hundred and fifty thousand dollars. This district is created for the purpose of affording a water supply delivered through the Asheville mains to meet the needs of four hundred families and, of course, to take care of the future needs of the district.

In considering the present sources of water supply to the City of Asheville, namely the watersheds of the North Fork of the Swannanoa and Bee Tree Creek, it is perhaps proper to observe that the very rapidly growing resorts and industrial communities of Black Mountain and Swannanoa are seated immediately at the outlets respectively of these two watersheds and it is reasonably believed by competent and conservative observers that the water supply needs of these communities and of the Swannanoa Valley as a whole will in a very few years approximate to the total yield of these two watersheds, to which alone they can look for a gravity supply of pure water.

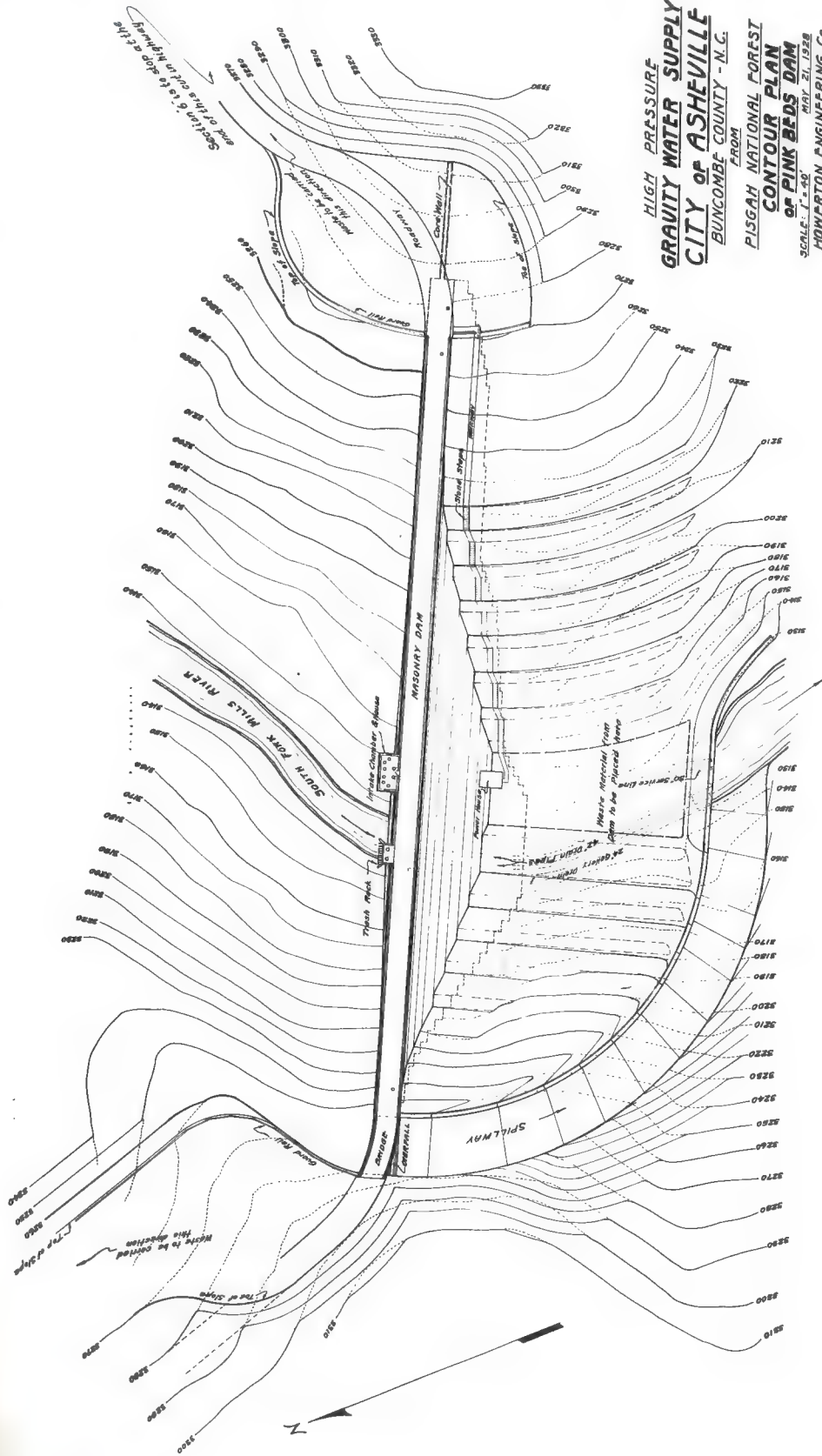
As a further indication of the rapid growth of the City of Asheville and emphasizing the merits of its request or application for the water from the Pink Beds source, we respectfully submit that the Post Office receipts at the Asheville office for the year 1926 were in excess of three hundred and fifty eight thousand dollars or approximately three times the receipts of that office in the year 1919, and that the Southern Railway Company handled in its Asheville yards during the calendar year 1926 more than one million loaded freight cars, or an average of approximately three thousand per day, which also represents an increase of approximately three to one over the year 1919. In the same period Asheville's banking resources have multiplied by five.

These somewhat sensational increases have been recorded in advance of the completion of the system of hard-surfaced roads which are credited with the greater part of Asheville's prosperity, and which are expected to yield even more sensational results in the continued growth of the said City during the next equal number of years.

It is deemed fair to say that the true urban community of Asheville at present is in excess of seventy-five thousand people and it is not doubted that the potentially water-consuming community will within a very few years easily double that number.

Asheville is no longer considered in the light solely or even principally of a summer resort. It is not only considered but is in fact both a summer and winter resort and in addition to this it is a rapidly growing commercial, industrial and transportation center, and in the event the proposed Smoky Mountain Park becomes a certainty—and we confidently believe it will—owing to the large private subscriptions as well as authorized legislative expenditures—Asheville will become a much more important center and we may confidently expect a much more rapid growth, both in population and industry. It is significant that all of this has come about through normal healthy growth without artificial excitation of any nature.

Your communication suggests the discussion of the French Broad River as a source of water supply for the City of Asheville. In the opinion of the authorities of said City the French Broad River is excluded as a permanent source of water supply from the considerations, first, that the waters of that stream can only be made available by pumping and, since Asheville shows a progressive tendency to grow to higher altitudes along the surrounding plateaus and mountain ridges, the costs of pumping a water supply for the said City is by no means negligible; and, second, and principally, the objection to a water supply drawn from the French Broad River, which is regarded as insuperable, is the heavy pollution of that stream not only



HIGH PRESSURE
GRAVITY WATER SUPPLY
CITY OF ASHEVILLE
 FROM
 BUNCOMBE COUNTY - N.C.
 PISGAH NATIONAL FOREST
CONTOUR PLAN
OF PINK BEDS DAM
 SCALE: 1" = 40'
 MAY 21, 1928
 HOWERTON ENGINEERING CO.
 ENGINEERS
 ASHEVILLE, N.C.
 DRAWING No. W-416 SHEET No. 42

by the discharge into it of the raw sewerage of numerous towns and villages above Asheville—Brevard, Hendersonville, Fletcher, Arden, Skyland, etc.—but also by industrial pollution from tanneries and wood-working plants at Rosman, Brevard, Pisgah Forest, and Hendersonville.

While it is not doubted that science is equal to such treatment of the waters of this stream, chemically and bacteriologically, as would render its waters fit for human consumption, it is not believed that the sentiment of the community could ever be reconciled to a water supply drawn from a stream subject to such pollution and particularly to the pollution of the fecal discharges in nearby towns and villages. In other words, the psychological objections to the waters of the French Broad River are regarded as even more important than the obvious expense, running necessarily to the income from several millions of dollars, that would be entailed in the dual processes of purification and pumpage.

While it is admitted, as stated, that it is possible to make the waters of the French Broad River potable, your attention is respectfully invited to the authorities which recognize that tannic acids and other wastes, chemical and organic, from tanneries, do create a very serious difficulty of treatment and it is doubted whether waters heavily polluted, as are the waters of the French Broad River from this source, can ever be entirely freed from the offensive consequences resulting from such pollution.

Certain it is that the limited use of the waters of this stream in dilution of large volumes derived from other sources during the past dry season had the effect of rendering the whole supply of the said City disagreeable to the taste as well as to the sentiment of the community.

The City is also asked to submit the views of its governing body as to the eligibility of the Pink Beds area as a source of supply. This area is commended to the favor of the city principally,

(1) By the fact that its watershed is entirely forested, and its forests conserved and protected by competent public authority;

(2) It is a region of admittedly exceptionally heavy rainfall, estimated, for lack of accurate records covering long periods, from a minimum of 78 inches to a maximum of in excess of 85 inches annually;

(3) A comparatively large and stable stream flow resulting from both the causes mentioned and from the extent of the watershed amounting approximately to an area in excess of twenty-five square miles, excluding the drainage area of Bradley Creek, which we understand to have been granted to another municipality; and

(4) Its wholly unique and extraordinary adaptability to water storage at a very high level.

Dealing with these factors in their reverse order, attention is called to the fact that the Pink Beds proper has a catchment of approximately ten square miles (seven thousand acres) and included in this comparatively small head waters area is a basin lying wholly above the altitude of 3168 feet, approximately fifteen hundred acres in expanse, which can be wholly flooded by a single dam not exceeding one hundred twenty-five feet in height, which would be located in the very narrow water gap through which all the waters of this area are drained and which affords dam sites ideal in all respects and by which a storage capacity of from nine billion to fifteen billion gallons is secured, depending upon the height of the dam, not exceeding the maximum stated.

The surface of such a storage reservoir would be at a level of 3250 or 3275 feet above the sea and it is a matter of some sentimental importance that this noble mountain lake, lying up toward the top of the Great Pisgah Ridge, would constitute a major scenic attraction for the ever-increasing multitudes who would avail themselves of the Government-built-and-maintained roads in the Pisgah National Forest area, this body of water being in plain view from the look-out points approached by these roads at the Buck Springs Gap, at Big Pisgah, Little Pisgah—indeed, the whole Pisgah Ridge, including the Big Bald Mountain—and from innumerable other and lesser points of vantage along said roads.

Such a creation, therefore, would not only be a valuable advertisement of the purity and volume of Asheville's stored waters, but it would likewise be the means of endless delight to seekers after the beauties of Nature in the National Forest area.

The Pink Beds storage has another supreme advantage which is believed to be altogether unique in Eastern America in that the stored waters would not be drawn upon directly by the extension of the supply pipe line to the reservoir, but the waters as required to replenish stream flow during seasons of low water would be released and allowed to run free in a remarkably tortuous and rocky channel for a distance of at least seven or eight miles before reaching the point of intake at the approximate level of twenty-six hundred feet, by which means all the advantages as to quality of water through storage in a large body and through the complete aeration and vivification in a steep and rocky stream channel would be secured not only without added costs but by the practice ~~is~~ a very signal economy.

It is believed and strongly insisted by the Engineers who have recently studied this area under the employment of the City, that the ten square miles of the catchment of the Pink Beds storage basin proper, at the head waters of the South Mills River watershed, will yield a run-off practically equal to and probably exceeding the run-off from the entire watershed of the North Fork of the Swannanoa of approximately twenty-two square miles, and it is entirely conservative to estimate that the Mills River watershed as a whole will yield a minimum stream flow at the point of emergence from said Pink Beds basin of from five to seven million gallons daily and the minimum stream flow at the proposed point of intake would be approximately double the stream flow at the higher level, this conclusion being predicated upon the fact that the drainage area at said point of intake would be practically double the drainage area at the higher location.

The Pink Beds-South Mills River watershed further commends itself to the favorable consideration of the City of Asheville as a source of water supply for the said City in that it appears feasible to the authorities of the said City ultimately to secure a large increase of supply from that area by the appropriation of the surplus waters of that watershed at the approximate level of twenty-three hundred feet, in order to provide a separate source of supply for all the industrial areas in and about said City which are almost wholly confined to the valley levels thereabouts of approximately two thousand feet.

The Pink Beds area appeals to the City of Asheville for the additional reasons that it is the only reasonably accessible watershed area suitable to augment the North Fork and Bee Tree sources of water supply in that its elevation is such that it can be delivered by gravity to storage distribution reservoir at the same elevation as the present storage distribution reservoir of the City of Asheville, thus eliminating the necessity of the needless expense of zoning and duplicating distribution reservoir facilities, and for the reason that the stream flow or run-off so vital to the life of the City of Asheville can be made available in a few months' time by the laying of a cast-iron main to the intake site.—What Asheville needs and must have is water at once. By this we mean it must have water which can be supplied by run-off or stream flow. We can not wait upon the delay occasioned by the construction and filling of storage reservoirs.

No other individual or municipality needs this source of water supply.

Asheville needs it and is not only financially able but, of necessity, will develop it at once.

II.

The General Plan for the Development of The Pink Beds Source of Water Supply, as will more fully appear by reference to the accompanying maps and the report of the Engineers, is as follows:

(a) The laying of a 30 or 36-inch cast-iron pipe main to the intake site at or near the mouth of Cantrell Creek.

(b) The building of the storage dam at the water gap which breaks the rim of the Pink Beds basin at the approximate stream level of 3168 feet.

(c) The ultimate impounding and appropriation of the surplus waters of the said watershed at or near the mouth of Bradley Creek.

III.

The Time Required to Complete the Various Stages of Development is approximately as follows:

(a) The laying of the pipe line to the proposed intake at or near the mouth of Cantrell Creek, approximately twelve months from the date of the grant of the necessary rights.



South Mills River—Above McCall Mt. Intake—Looking Up Stream

(b) The building of the impounding dam or reservoir, to begin immediately after the completion of the pipe line as before stated.

(c) To be governed by necessity and the advice of engineers as to the feasibility of the utilization of said surplus waters.

IV.

The rights to water insofar as they have been determined:

The statute laws of North Carolina expressly confer upon the governing bodies of municipal corporations the right in their discretion to acquire by purchase or condemnation watersheds and rights-of-way for pipe lines for municipal water supply and the decisions of the highest Courts of said State recognize the right so conferred as being within the discretionary powers of said governing authorities, so that they are deemed the sole judges of the necessities of the corporation in the first place and of the appropriateness of the lands and water rights and rights-of-way to the uses designed; so that the full rights of the City of Asheville in this respect are not in any particular open to question, as the City is advised by counsel learned in the law.

The rights of riparian owners affected by such appropriations are equally established and recognized in this State, so that any riparian owner who claims to be injured by such appropriation of waters for public uses has full right to have his damages assessed by the Courts.

A machinery is provided for the exercise of the right of eminent domain where the municipal corporation is unable to contract with the owners of the lands and rights-of-way required by it and the damages sustained by such owners are assessed in that proceeding, but the law does not seem to require the municipality to extinguish the rights of lower riparian owners affected by its appropriation of waters as a preliminary to its taking such waters.

In the present case, since there would be no question between the Government, as the owner, and the Municipality, it is believed that nothing would be required of the City, by way of the acquisition of rights under the law of eminent domain, except as to its right-of-way, and as to those the requirement is that the City shall endeavor in the first instance to acquire such rights-of-way by treaty between the parties and, failing that, the machinery is provided to acquire them by proceeding under the aforementioned condemnation proceeding.

As a practical matter it is believed that there are no substantial riparian interests to be affected by the City's appropriation of the waters now applied for but, if this is not correct, no legal difficulty would stand in the way of the owners who thought they were injured in their actions to recover such damages as they could show they had sustained by the appropriation of said waters.

In short, the City is advised that there is no legal difficulty whatsoever to be apprehended in the present instance and all damages legally ascertained will be paid by the City and the City would consent that any lease or permit granted to it by the Forest Service should be coupled with the condition that it should pay off and fully discharge all legally ascertained claims for damages.

V.

The Resolution of the City of Asheville authorizing this application is as follows:

"STATE OF NORTH CAROLINA,
"COUNTY OF BUNCOMBE.

"E. G. Thompson being duly sworn deposes and says that she is the Secretary-Treasurer of the City of Asheville, and as such Secretary-Treasurer has charge and is legal custodian of the minutes of the Board of said City.

"That on the 3rd day of November, 1926, at 9:00 A. M. in regular session assemble the City Commissioners, all members of said Governing Body being present, it was upon motion of F. L. Conder, Commissioner of Public Works, duly seconded by C. H. Bartlett, Commissioner of Public Safety, said

Mayor and Commissioners voting unanimously in the affirmative, among resolutions passed the following:

"The Water Commission heretofore created and appointed having completed its duties is therefore dismissed with the thanks of the Governing Body of the City of Asheville. And the Governing Body of the City of Asheville directs the Mayor-Commissioner, to proceed to acquire the land in the North Fork area as this Board by resolution has heretofore provided, and said Board, in its discretion, finds as a fact that it is necessary for the public good of the citizens and taxpayers of the City of Asheville that said City of Asheville immediately acquire from the United States Government either by lease or purchase or otherwise the South Fork of Mills River and Bradley Creek and their tributaries or the Pink Beds or what is known as the Pink Beds Watershed area described in The Ludlow Engineers report, and the Mayor-Commissioner of Finance, is authorized, fully empowered and directed to immediately make application through the proper officer to the United States Government and do everything incident and necessary looking to the acquirement of the Pink Beds Watershed area for the use of the inhabitants of the City of Asheville.

"The Secretary-Treasurer of the City of Asheville is directed to spread a copy of this resolution upon the minutes of the Board and transmit a copy of the same to the aforesaid Water Commission of the City of Asheville."

(Signed) JNO. H. CATHEY,
Mayor-Commissioner of Finance.

"ATTEST:

(Signed) E. G. THOMPSON,
Secretary-Treasurer.

"Affiant further avers that the above resolution is of record and spread upon Minute Docket No. 22 at pages 125, 126, 127 and 128.

(Signed) "E. G. THOMPSON,
Secretary-Treasurer.

"Sworn to and subscribed before me this the 18th day of January, 1927.

(Signed) "W. A. BRAMLETT,
Notary Public.

"My Commission expires
June 29th, 1928".

(SEAL)

A true copy of the foregoing document is hereto attached, marked "City of Asheville Exhibit B".

VI.

Map in Diagrammatic Form Showing The Various Sources and Plans for Development:

These maps accompany this application.

A copy of the Engineers' Reports is attached hereto and transmitted herewith for your inspection.

We respectfully submit that the City of Asheville occupies the unique position of furnishing a water supply to the United States Government Hospital at Oteen and that therefore it would be proper for the Government to cooperate with the City of Asheville in its effort to supply this institution, as well as its other needs, thus putting the City of Asheville in position to become much more attractive to the thousands of visitors who wish to enjoy the forest areas owned in this vicinity by the United States Government.

In conclusion, we wish to submit an additional reason for immediate favorable action upon this application.

The development of this project will, of necessity, require money. The General Assembly of the State of North Carolina is in session and will be until about the first of March. It is necessary, in order to facilitate matters, for us to have some legislation relative to raising finances and we are ready to secure the passage of such legislation as soon as we are advised of your favorable action upon this application.

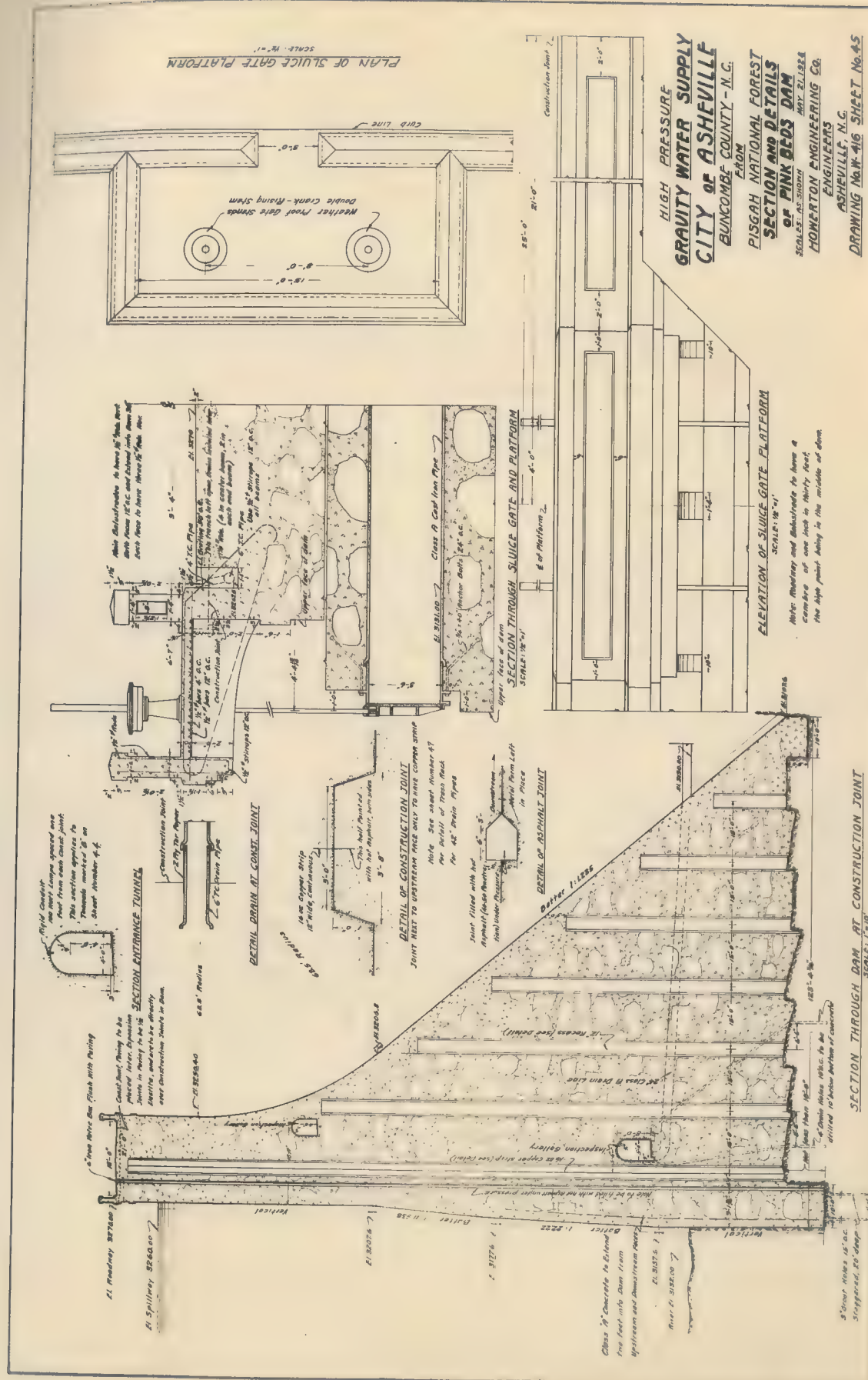
Respectfully submitted, this twentieth day of January, 1927.

CITY OF ASHEVILLE, NORTH CAROLINA,

By J. W. HAYNES,

Attorney at Law and in Fact.

FRANK CARTER, of Counsel.



L—Uses—Pisgah.
City of Asheville—Watershed.

HON. EVAN W. KELLEY,
*District Forester,
Eastern District,
Forest Service,
U. S. Dept. of Agriculture,
Washington, D. C.*

Dear Sir:—

On January 20, 1927, the City of Asheville filed a formal application with your Department for the use of the water supply afforded by what is known as the Pink Beds area in the Pisgah National Forest, embracing the entire watershed of the South Fork of Mills River except so much thereof as drains into Bradley's Creek.

With your permission, the City of Asheville now submits for your consideration, in addition to and supplementing its statement of January 20th, facts as follows:

I.

C. D. Justice, an engineer of the Carr Lumber Company, on oath makes a statement in words and figures as follows: "C. D. Justice being duly sworn says; That he has been the Engineer for the Carr Lumber Company for about seven and one-half years, part of his duties being the laying out and the construction of railroad lumber roads, and that it is not a fact as alleged in the petition of the City of Hendersonville in their application for a lease of the Pink Beds Watershed from the United States Government; that the Carr Lumber Company in building railroads or lumber roads are doing no work of any kind or character on the present Hendersonville Watersheds; That it is true that the Carr Lumber Company has a lease for the timber rights on this watershed, but that it will be approximately eighteen months or longer before they will begin operations above their present intake, and that the Carr Lumber Company is not now engaged in any operations which at the present time is polluting the Hendersonville water supply, their present camps being at the head of Slate Rock Creek, a tributary of Bradley Creek, said camp being on the opposite side of a dividing ridge between the intake and the camp; That in the opinion of affiant there is sufficient source of water in what is known as Wash Creek, which is a tributary of North Mills River, that could be utilized by Hendersonville as a water supply while the Carr Lumber Company is engaged in logging or other operations, above the intake of the present Hendersonville water supply. Affiant is also of the opinion that this was the original plan contemplated by the Hendersonville Water Commission; and he is also of the opinion that this area drained by what is known as Wash Creek, and which is also under lease by the Carr Lumber Company, could be left in its present uncut condition, and that the Carr Lumber Company, in his opinion, would agree to allow this to remain intact until they had cut over the Hendersonville Watershed above the present intake. Bradley Creek will be released within six months and they could use that source in place of the present source of supply during the operations of the Carr Lumber Company, which source would be sufficient to supply Hendersonville for a period of from five to seven years; and affiant is of the opinion that Hendersonville is not using more than one-third of the present run-off from the North Mills River.

(Signed) C. D. JUSTICE.

Sworn to and subscribed before me this 11th day of February, 1927.

(Signed) J. B. HOOKS, JR.
Notary Public.

My Commission expires 10-13-28, "which affidavit is hereto attached and marked, "City of Asheville's Exhibit 'D'."

II.

That according to weir measurements made October 5, 1922, of an area of 8.2 square miles draining into Bradley's Creek, it was found that there was a daily flow or run-off of 3,930,000 gallons.

In the formal application of the City, we overlooked giving you the information of the establishment of the Hazel Water District supplying a large number of people in a fast growing industrial and manufacturing village consuming a large quantity of water daily, which is being supplied by the City of Asheville.

The Swannanoa Sanitary Sewer District has been changed since the filing of the City's application to a water and sewer district, and the engineers estimate that it will take not less than 3,000,000 gallons of water per day to supply this District.

A large Sanitary District has been created to the north of the City in Beaver Dam since the filing of the City's formal application. This will be supplied by the City of Asheville and will require a large quantity of water.

The following is an estimate of the additional water that will be necessary for the present needs of these four districts, and you will note that there is no estimate for either Caney Valley or Beaver Dam, as we have no actual figures available on these two districts:

Swannanoa Sewer District	-----15,000 people @ 200	3,000,000
South Buncombe Water District	-----2,500 people @ 200	500,000
Emma Water District	-----2,500 people @ 200	500,000
Woodfin Sewer District	-----3,500 people @ 200	700,000
or a total of 4,700,000 gallons per twenty-four hours.		

III.

The City of Asheville and Buncombe County, through the senator and representatives of Buncombe County have prepared all necessary legislation looking to the development of the Pink Beds or South Fork of Mills River Water Project, and the same is at this time, as rapidly as procedure will permit, being passed through the General Assembly of North Carolina.

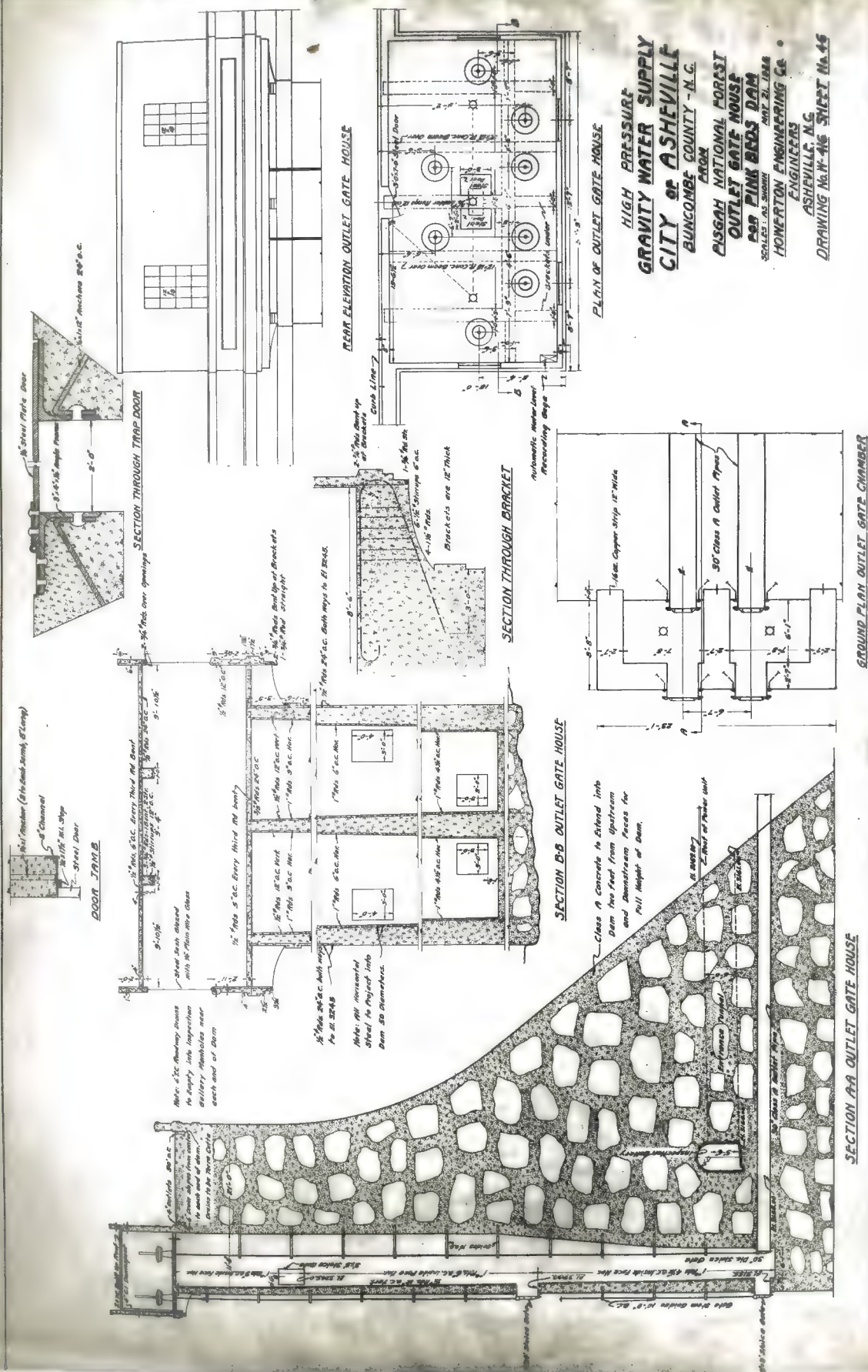
IV.

In the event that the United States Government allows the formal application of the City of Asheville, and permits it to develop this water project, the City of Asheville will, in case there is more water in this source than is necessary for its reasonable needs, and the town of Hendersonville wants and requests the use of such excess, sell the same to the town of Hendersonville, or otherwise permit the town of Hendersonville to use the same during the time the logging operations are being carried on on its present watershed.

That after logging operations have been completed on its watershed, should the town of Hendersonville at any time need water from this source and the City of Asheville have an excess, the City of Asheville will be glad to divert such excess and sell the same to the town of Hendersonville.

Moreover, should it develop that there is an excess of water over and above the needs of the City of Asheville and the County of Buncombe, and it appear that the northern Mills River or Fletcher section of Henderson County need the same, the City of Asheville will make every effort to supply the wants of these communities.

In short, notwithstanding the fact that Asheville and all of Buncombe County as well as the sanitary districts and the smaller towns served by the Asheville water system are vitally interested in securing this water supply, the City of Asheville is not unmindful of the water needs of other communities, and will aid in every way in its power the development of these communities.



For your information we are submitting herewith an article by W. Scott Radeker appearing in the Asheville Citizen, January 30, 1927.

Respectfully submitted, this fourteenth day of February, 1927.

CITY OF ASHEVILLE, NORTH CAROLINA,

(Signed) By J. W. HAYNES,

Attorney at Law and In Fact.

FRANK CARTER, *Of Counsel.*

COL. W. B. GREELY,
*Chief of Forest Service,
U. S. Dept. of Agriculture,
Washington, D. C.*

L—Pisgah Uses—Watershed
South Fork of Mills River

Dear Sir:

The City of Asheville in the State of North Carolina on January 20, 1927, filed a formal application with your Department for the use of the water supply afforded by what is known as the Pink Beds Area in the Pisgah National Forest, embracing the entire watershed of the south fork of Mills River except so much thereof as is drained in the Bradley Creek. Thereafter the Town of Hendersonville made application for the use of the same water from the same source.

The matter came on for hearing at eleven o'clock A. M. in the Federal Building at Asheville, North Carolina, on February 15, 1927, at which time the matter was heard, all parties being represented and on March 5, 1927, the District Forester, Mr. Evan W. Kelly, made his findings of fact as a result of the information secured at this hearing.

Finding of Fact of District Forester, Evan W. Kelly:

L—Pisgah Uses—Watershed
South Fork of Mills River

The City of Asheville,
Attention: J. W. Haynes, Attorney,
Asheville, N. C.

March 5, 1927.

Dear Mr. Haynes:

The applications, reports, testimony, and other data, together with information derived by personal investigation by forest officers in reference to the applications of the Cities of Asheville and Hendersonville, N. C., for a watershed permit covering designated areas within the watershed of the South Fork of the Mills River, Pisgah National Forest, in North Carolina, have been reviewed and analyzed. The presentations in the conflicting applications have also been weighed one against the other. My finding is:

The City of Asheville is confronted today with a shortage of water from satisfactory sources. The City is in immediate need of the water supply described in its application to utilize the designated portion of the South Mills River Watershed. It is capable of proceeding promptly with the described development, and has declared its intention to develop as rapidly as possible, the full potentialities of the territory covered by this application.

The City of Hendersonville is amply supplied at present, and furthermore, it has yet undeveloped about 60 per cent of the potential capacity of the area covered by its existing permit dated May 16, 1922, from the Secretary of Agriculture. There has been no adequate showing made to prove the undesirability of the watershed of Bradley Creek, and of the undeveloped portions of the North Fork of the Mills River. Another fact is that the City of Hendersonville does not need the full development of the South Fork of the Mills River to supply its water requirements until after 1935.

In view of these presentations, the equities of the situation merit that the District Forester recommend to the Forester that the City of Asheville be granted a permit for the area and for the purposes described in its application, subject to an execution of an agreement with the Secretary of Agriculture containing provisions to adequately safeguard public interests, and empowering the Secretary of Agriculture with the right to reserve for the benefit of communities adjacent to and dependent upon that portion of the National Forest for a domestic water supply, the right to obtain water from the water system of the City of Asheville under such terms of service and payment as he may consider reasonable, provided that no other sources of water supply are available to said communities at a reasonable cost, and that said community shall demonstrate such needs to the satisfaction of the Secretary of Agriculture.

The permit to the City of Asheville will require that the City shall install such reservoirs and conduits as will provide for the maximum development of the South Mills River watershed, including ordinary flood stages, to practicable limits as dictated by sound engineering practice. The development to be in stages as may be required to provide for the requirements of Asheville and other communities, dependent upon this watershed for water supplies.

The normal forest activities will continue upon the area. The permittee will be required to comply with all regulations of the department, and any additional protection deemed necessary by the City will be furnished by the Forest Service at the expense of the City of Asheville under a cooperative agreement with the District Forester, which will specify the character of service to be rendered, its cost, and prescribed methods of payment.

The District Forester in view of the considerations stated, has recommended to the Forester that the application of the City of Hendersonville be rejected.

Either applicant has the right of appeal to the Forester from this decision, under the provisions of regulation A-10, provided that notice of intention to appeal is given within 10 days of the date of this notice.

Transcript of the hearing is attached hereto for your records.

Very sincerely yours,

(Signed) EVAN W. KELLEY

E. W. KELLEY,

District Forester.

Enclosure.

This finding of the District Forester is unquestionably just and proper and is borne out not only by the greater weight of the information produced at this hearing but by every circumstance in connection with this matter.

The City of Asheville filed no exceptions to the report and finding, it being fully satisfied that such report was just and proper. The Town of Hendersonville, however, gave notice of appeal from the finding and report of the District Forester.

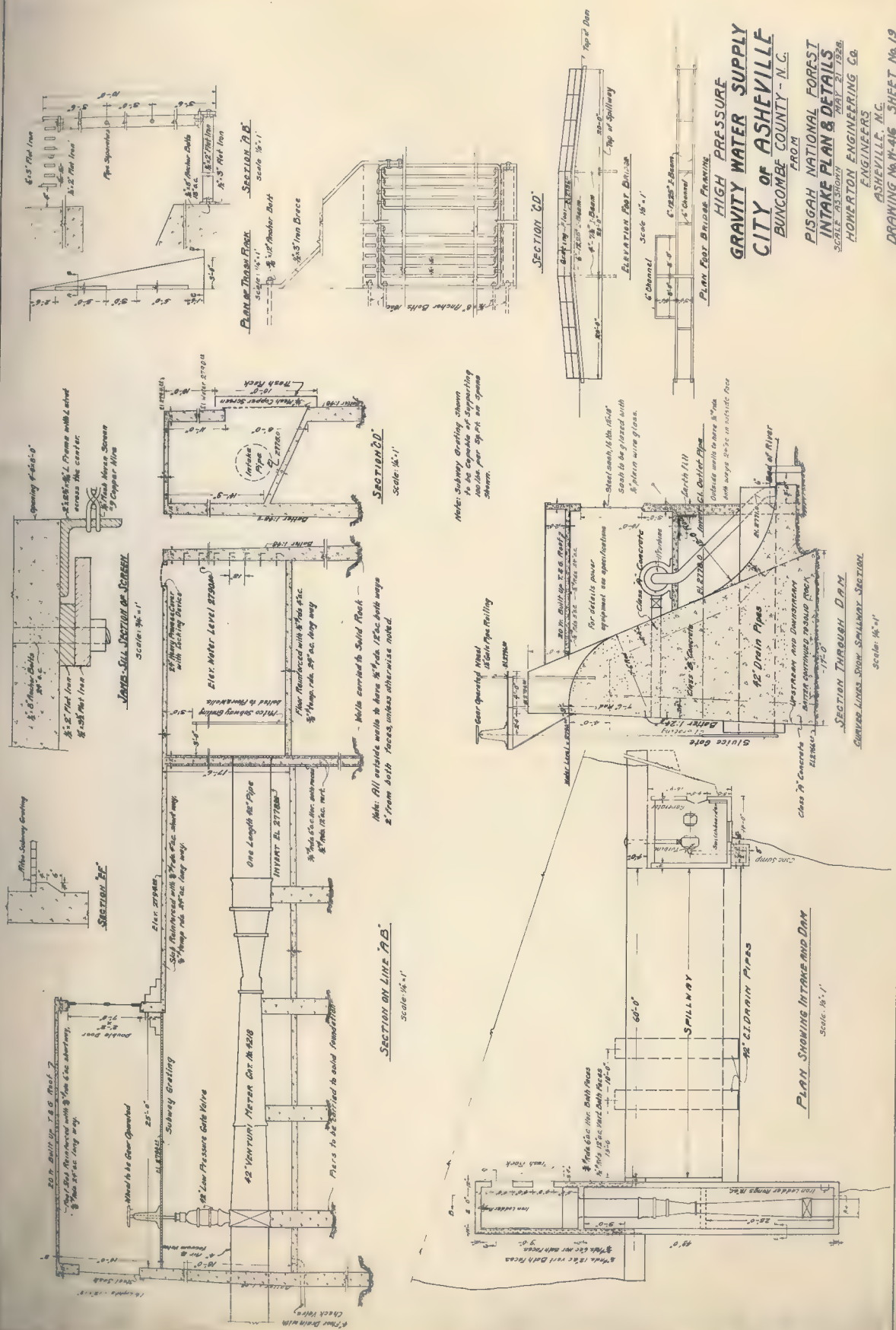
A careful perusal of the appeal of the Town of Hendersonville, a copy of which was furnished to J. W. Haynes, representing the City of Asheville, as per instructions of the Department, fails to disclose the slightest suggestion of additional information relative to this matter.

EXCEPTIONS OF THE TOWN OF HENDERSONVILLE

The Town of Hendersonville accepts only and appeals from only two of the foregoing findings of fact as follows:

"The City of Asheville is confronted today with a shortage of water from satisfactory sources. The City is in immediate need of the water supply described in its application to utilize the designated portion of the South Mills River Watershed. It is capable of proceeding promptly with the described development and has declared its intention to develop as rapidly as possible, the full potentialities of the territory covered by this application."

(Pages 1 and 2 of the Appeal of Hendersonville.)



The second exception to the report and finding of fact of the Town of Hendersonville is as follows:

"The City of Hendersonville is amply supplied at present and furthermore it has yet undeveloped about sixty per cent of the potential capacity of the area covered by its existing permit dated May 16, 1922, from the Secretary of Agriculture. There has been no adequate showing made to prove the undesirability of the Watershed of Bradley Creek, and of the undeveloped portions of the North Fork of the Mills River. Another fact is that the City of Hendersonville does not need the full development of the South Fork of the Mills to supply its water requirements until after 1935."

(Appeal of the Town of Hendersonville, page 20.)

The appeal of the Town of Hendersonville discloses no further exceptions to the foregoing report and finding of fact, and we therefore assume that the Town of Hendersonville is precluded from discussing further finding of fact on this appeal.

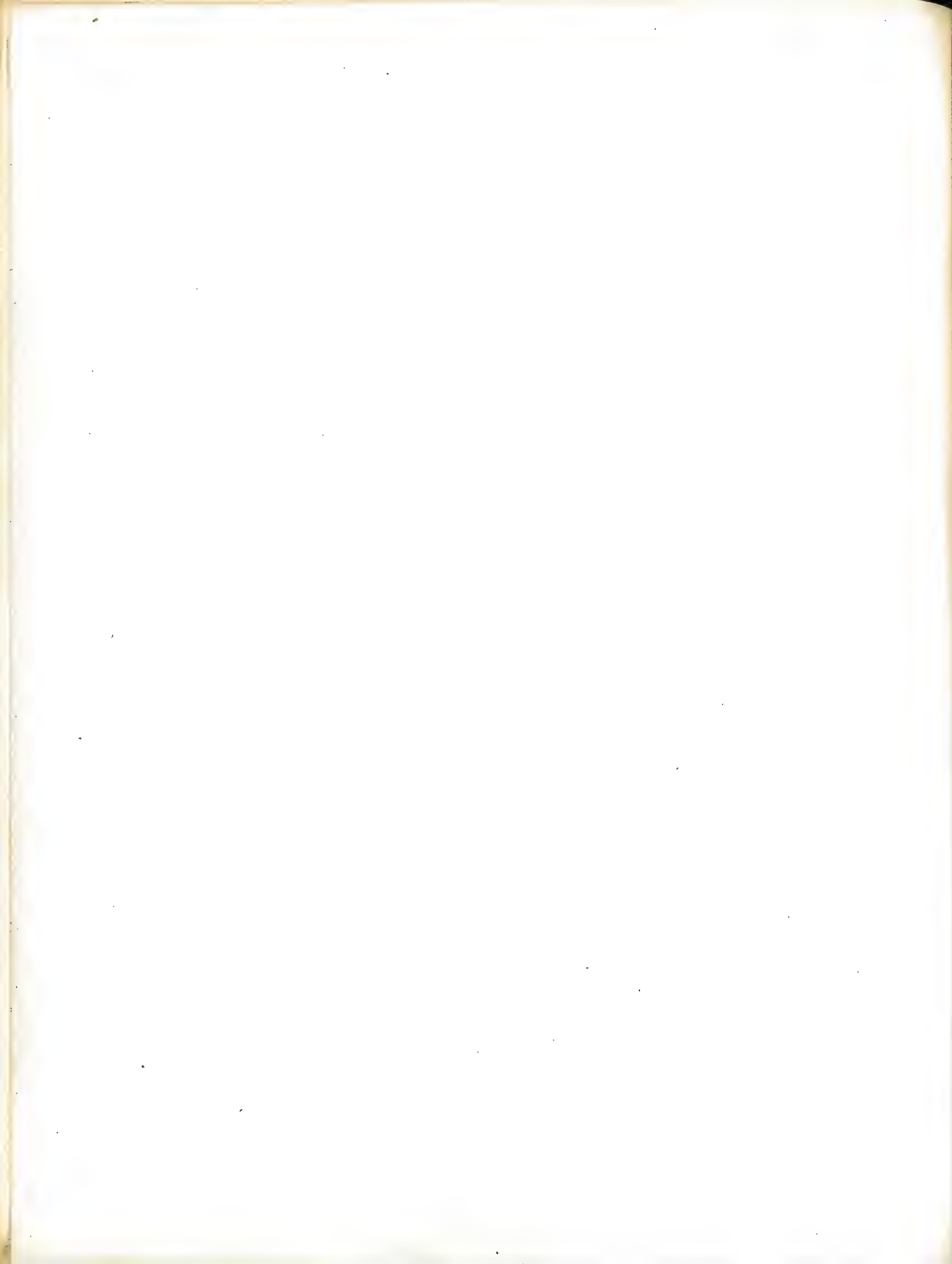
ARGUMENT

The first finding of fact is sustained by the record of the report of the conference under date of February 15, 1927. (See formal application and the supplement thereto, which supplement is set out in the report of the hearing, pages 4, 5, 6, 7, and 8 of the report.) The formal application is also of record but not set out in the report. Further bearing on this exception, the City of Asheville respectfully calls your attention to the record of this conference, pages 9, 10, 11, 12, 13, 14, 15, 16, 17, and a part of page 18; also pages 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, and 48. In short, almost the entire record which was developed in the presence of the representatives of the appellant, the Town of Hendersonville, contains a true story of the imperative need of the City of Asheville substantiating this finding of fact.

As to the second finding of fact that Hendersonville's present potential source of supply is about 60% undeveloped, your attention is respectfully called to the report of this conference as the same appears on page 5 in the affidavit of C. D. Justice, an engineer of the Carr Lumber Company, the original of which affidavit is filed as an exhibit and is therefore a part of the record. The further statement that according to weir measurements made October 5, 1922, of an area of 8.2 square miles draining into Bradley Creek, it was found that there was a daily flow or runoff of 3,930,000 gallons. (Report page 6.)

Your attention is especially called to this excerpt from page 16 of the report:

"Practically all the water in Western North Carolina, in this section east of the Candler Mountains, except Pigeon River, runs by or near the door of the Town of Hendersonville and it is a source. It is not available to them now, but could be made available to them if they need it. Further, there is a supply from Little River, which is a wonderful supply of water. From our point of view, the Town of Hendersonville has water on the south, on the west, and has available by gravity more than enough water to take care of this entire section; but all is a matter of record and they are the judge or they are to be governed by their opinion and their views, and we are submitting our views and our opinion, and you gentlemen have these facts in the record. It is an interesting story to us, it is a vital story to us, and it means life. It means the future growth of this city. We cannot advertise to the world today that we have an abundant water supply—the Town of Hendersonville can advertise that they have abundant water supply, and have advertised that they have. They have gone so far, some of the citizens up there, as to impress upon the inhabitants of the Town of Hendersonville the needs of the City of Asheville. We have heard them do it, and it is a matter of general information to us, and until this application was filed we had no idea that the Town of Hendersonville wanted or needed more water. We don't want to deprive them of anything. They have an abundant supply of water and we have their admission to it prior to the time that their request was filed in this manner." It is significant that at the time Hendersonville was advertising this abundant flow of water, adequate for all of its needs, that according to its own statement its supply varied from 1½ million to 2,113,000 gallons of water per day, with the further statement from its representative Mr. Wright that the Town of Hendersonville used the entire capacity of the pipe lines only three days out of thirty-



as the people of the City of Asheville to the inevitable conclusion that we could not rely in toto upon these reports or any of them.

The record of the conference, pages 38 to 48, is almost exclusively taken up with the discussion of the reports of these engineers and your attention is especially called to these pages in the record.

COPIES OF AFFIDAVITS OF ENGINEERS USED BY THE CITY OF ASHEVILLE IN LITIGATION WITH TAX PAYERS ATTACHED TO APPELLANT'S CASE ON APPEAL.

The appellant, Town of Hendersonville, has through lack of memory or failure to read the record of the hearing in this matter charged that certain information with reference to litigation between taxpayers of the City of Asheville and the City of Asheville was not disclosed at this hearing, and in an effort to make a showing, have devoted almost their entire case on appeal to affidavits of engineers filed in this court proceeding.

This occurs to us as being novel in view of the fact that the Mayor of the City of Asheville courteously furnished the representatives of the Town of Hendersonville, without consideration, a copy of the so-called Waddell report embracing the reports of Freeman, Smith, and others for the use of the Town of Hendersonville in preparing its case on appeal. But this is not all—the representatives of the Town of Hendersonville have in some manner, mysteriously or otherwise, been able to attach copies of the affidavits made by these engineers, at the direction of the attorneys for the City of Asheville, of record in the aforesaid litigation; written by a stenographer in the employ of these attorneys, paid for by the City of Asheville, and supplied to the Town of Hendersonville in such quantities that it has been able to serve a case on appeal in this matter and deliver to the City of Asheville a copy of the same, which has attached these copies of affidavits in their original form and covers—yet the representatives of the appellant, in their gracious fairness, would have the Department to believe that there is something hidden. Moreover, the copies of affidavits filed with the case on appeal contained nothing new. These affidavits are reiteration of matters contained in the reports of engineers of record, which have been submitted for your inspection. Recurring to the report of the hearing in this matter, page 41 et seq., this litigation is discussed at the instance of Mr. Wright, and without further encumbering the record, the City of Asheville especially calls this to your attention in order to emphasize that the appellant has found nothing new, either as to what these engineers, might, would, or did swear or the purpose of the City when it has acquired the additional area on the North Fork of Swannanoa River as to its development, after the development of the Pink Beds, should we be able to acquire the Pink Beds. We have been frank to say that we need both and we think that the gentlemen passing upon this fully understand the position of the appellee.

In passing, may the appellee be permitted to say that the litigation, in which these affidavits that the appellant emphasizes so much were used, has been compromised and settled, thus avoiding any possible embarrassment relative to verity and, the City is proceeding to condemn this additional land on the North Fork of the Swannanoa for the purposes and the reasons stated in the record.

This proposed impounding reservoir, at what is known as the Burnett site, can be nothing more than a low pressure proposition, as this site is 2550 feet, measured from the top of the dam as against 2710, the Bee Tree site. According to the information the City of Asheville has from the available engineering report, as the appellee has fully explained in the record, we must have water at an earlier date than it is possible to develop this source by building an impounding reservoir.

We still have the filtering plant on the French Broad River. This has been an unusually expensive proposition. The engineer's estimate was \$70,000.00, and the actual cost in excess of \$162,000.00. The estimate on the Bee Tree dam was \$360,000.00; the actual cost is in excess of a million, probably \$1,100,000.00. Regardless of our flattering reports, we expect to be forced to use the filtering plant on the French Broad again this summer. In any event, it is being held in readiness. This the City of Asheville mentions for the purpose of emphasizing the absolute merit and justice of the finding of the District Forester relative to the immediate needs of the City of Asheville.

Again, may the City of Asheville reiterate that it and the County of Buncombe, and each of them,

are authorized by proper legislation to develop the source of water supply described in the formal application, and that the taxable assets of both the City of Asheville and the County of Buncombe are available for the immediate development of this water project.

Our large water and sewer districts, as set out in record, are either constructed or in the course of construction and every statement of the record is being complied with in the highest good faith, and the City of Asheville is ready to proceed with the development of the Pink Beds as soon as permitted by your Department.

This the eighth day of April, 1927, respectfully submitted.

CITY OF ASHEVILLE, NORTH CAROLINA,

By J. W. HAYNES,

Attorney at Law and In Fact.

FRANK CARTER, *Of Counsel.*

IN THE MATTER OF ASHEVILLE WATER SUPPLY.

Report 112.

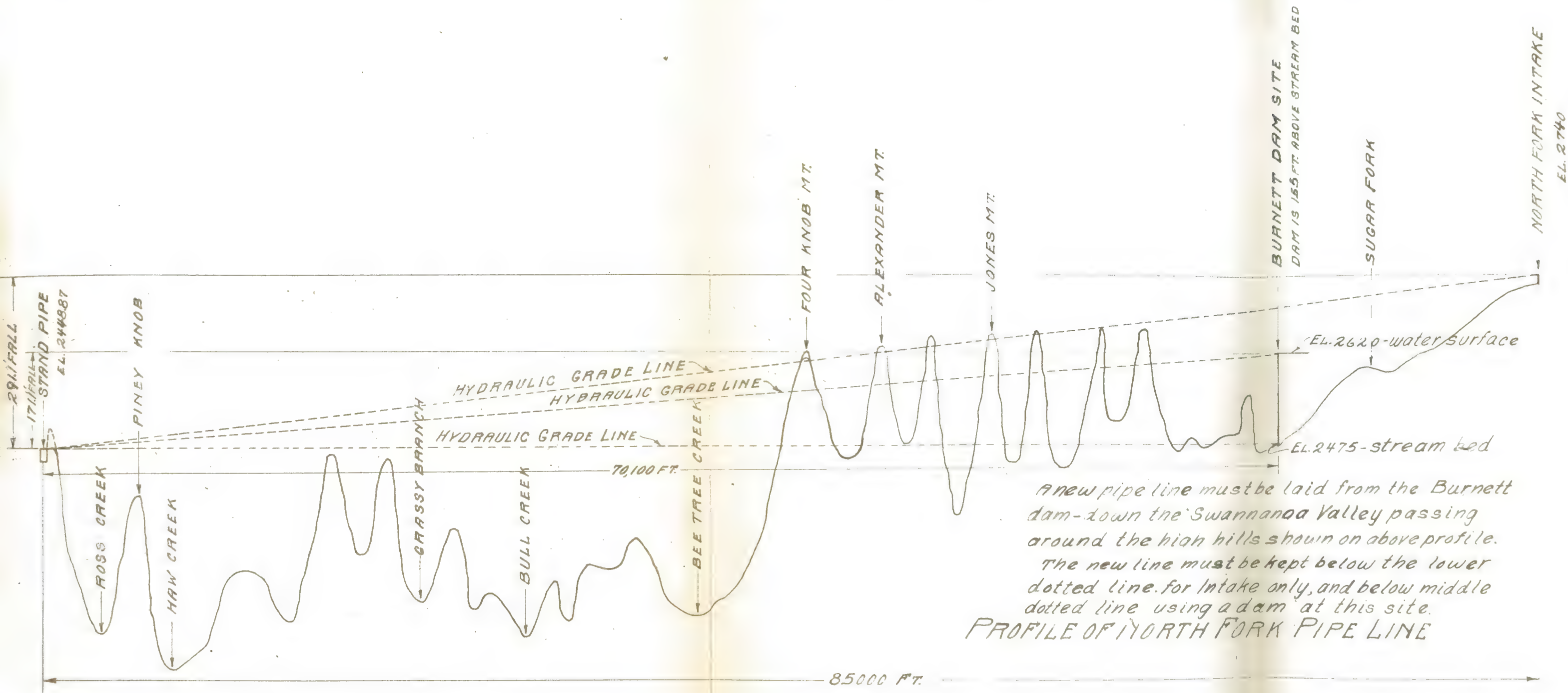
In October, 1925, Chas. E. Waddell submitted a report on "Water Supply Studies for the City of Asheville," known as Report No. 112, to the Mayor and Commissioners of the City of Asheville. This report deals with several probable sources of supply and incorporates therein a report from Harry L. Parker, John R. Freeman and others. In the injunction hearing relative to the proceeding by the City of Asheville for the purchase of additional water supply area on North Fork, heard before McElroy, Judge, in Marshall, the report referred to was sworn to by Mr. Waddell and submitted to Judge McElroy in the form of an affidavit, together with affidavits of Waldo Smith, John R. Freeman, Meese & Meese, Gilbert White and other engineers, all of which reports and affidavits were passed on by Judge McElroy and later by a conference hearing, including the Attorney for the Forest Service in the Department of Agriculture of the U. S. Government; and in this connection, it might be of interest to say that the U. S. Government sent its engineer, Mr. Dort, to Asheville, and that Mr. Dort went over the Bee Tree, North Fork and Pink Beds, with the idea of making investigations for the purpose of making recommendations to the Department of Agriculture relative to the needs of the City of Asheville with reference to the development of sources of water supply. With all information before the Department of Agriculture—the same being a matter of record and on file for public inspection in the City Hall in the City of Asheville—the U. S. Government, through its engineers and its Chief of Department in the Forest and Agriculture Service, found as a fact that the City of Asheville needed for immediate development that source of water supply known as the South Fork of Mills River or the Pink Beds area.

On page 56 of Report No. 112, made by Mr. John R. Freeman on November 24, 1923, Mr. Freeman says:

"I find myself in general agreement with the report submitted by Mr. Charles E. Waddell, Consulting Engineer of Asheville, addressed to you on July 7, 1922, and I heartily endorse nearly all of his recommendations."

Mr. Waddell, on pages 115 and 116 of said Report No. 112, under the topical heading of "Other Water Supply Sources," has this to say:

"As the years go by the urban and rural population of Buncombe County are bound to increase many fold. As the Mt. Mitchell is preeminently the natural source of water supply from the east, so is Pisgah area the natural water supply from the west. The United States Government has set apart in perpetuity Pisgah Forest. The valley lying to the southeast of Pisgah, known as the Pink Beds and in which the South Fork of Mills River rises, affords a natural site for a lake. The catchment area approximates 10 square miles and a dam 100' high, built at the point where the river leaves the valley and enters the gorge, will form a lake of 700 acres, about 1½ times the size of the old Toxaway Lake. I surveyed the entire Pisgah Forest several years ago for the late George W. Vanderbilt and studied the water and power



entire Pisgan forest several years ago

resources. For power sites the streams are of little worth; for city water supplies they are of inestimable value. Recently there has been considerable discussion of these resources and I have taken the precaution of asking a priority claim for the City of Asheville for the Pink Beds site and for the Bent Creek site. I should consider it nothing short of a calamity to see either one of these sources used for purposes other than city supplies. Other cities realize the worth of pure water. The City of Los Angeles spent \$25,000,000 and constructed an aqueduct and pipe line as far as from Asheville to Raleigh, tunneling through several mountain ranges—all for pure water. Asheville's supply is cheap and almost limitless."

In the report of Mr. H. L. Parker on pages 125 and 126 of said Report 112, the following appears:

"There is now available one water shed that Asheville should immediately secure for development in the near future before it is taken up by some other city; this is the South Fork of Mills River which emerges from the Pink Beds in the Pisgah National Forest at an elevation of about 3,250 above sea level which is fully 500 feet higher than the intake on North Fork. This stream has a drainage area of about ten thousand acres which is the same as the North Fork drainage area and the rainfall in the Pink Beds is so much larger than on North Fork, that it will be found that the average low flow from the Pink Beds is almost if not fully equal to the low flow from North Fork and Bee Tree combined.

"The superior height and rainfall of the Pink Beds make it possible to deliver in Asheville four and one-fourth million gallons daily through one sixteen-inch pipe as the fall is 5.4 feet per thousand against a fall of 3.5 feet per thousand on the present lines from North Fork and Bee Tree; this amount of water is equal to that which we now receive through two sixteen-inch lines and is sufficient for a population of 42,000.

"Another advantage of the Pink Beds as a source of supply is the fact that there is a storage reservoir site of 1,500 acres that could be developed at a cost that will be found to be very much lower than these reservoirs can be built on either North Fork or Bee Tree for an equal area of land.

"This storage reservoir in the Pink Beds would conserve all of the rainfall of the 10,000 acres and the daily flow from it would be increased from 4,250,000 gallons to 27,000,000 gallons daily or sufficient water for a population of 270,000, in addition to the number that can be served from North Fork and Bee Tree. North Fork and Bee Tree when fully developed will be able to deliver an equal amount so that the three streams would serve a total population of 540,000 which is more than ten times our present population."

On pages 99 and 100 of Report 112, Mr. John R. Freeman has this to say with reference to the development of the Burnett site on the North Fork of the Swannanoa:

"Unfortunately, for present needs, I find the elevation of this Burnett reservoir site is such that it could not be made available without a new pipe line. Whenever the time comes, perhaps 10 years or more hence, for a new pipe line from the watersheds, this new pipe could follow more nearly the course of the Swannanoa River and give a gravity delivery to the low-service district of Asheville.

"At present it cannot be made available thru the present pipe lines because of these having been run part of the way at much higher elevation than this reservoir site, across lots, over hills and hollows, in the effort to obtain the straightest possible course between the respective intakes and the reservoirs at Beau-catcher Gap.

"A reservoir at this Sherrill-Burnett site would be about 13 miles distant, by pipe line, from the city and its flow line could advantageously be placed at elevation 2550, or, in the early stages, at 2525. The lowest limit of draft could advantageously be placed at elevation 2500. This would give 200 feet of head for delivery into the proposed low-service zone of Asheville, which is ample to enable a pipe 24 inches in diameter to carry 7 million gallons per 24 hours to the city, even after it has become old and encrusted with deposits. This reservoir, with dam flow line at 2525, would probably supply double that quantity."

From the foregoing, you will see that the Burnett site is only available for low pressure service and what Asheville needs instantly is an adequate high pressure water supply service.

Col. J. L. Ludlow, at a cost of \$32,500.00, made an extensive and exhaustive survey and findings of fact as to the relative merits of North Fork and the Pink Beds as sources of water supply. Col. Ludlow finds that the Pink Beds is a more abundant source and a cheaper source to develop than the North Fork.

The City of Asheville in its formal application for a permit from the Department of Agriculture to develop the Pink Beds made a detailed statement of its plan of development. This detailed statement was given wide publicity.

The City of Asheville, by formal resolution, deemed that it was wise and advantageous to secure the Pink Beds.

The present City administration took the matter of the development of the Pink Beds under advisement and made a complete and thorough investigation of the needs of the City of Asheville for an increased water supply and the possible sources of such increase. After four months deliberation, the City of Asheville concluded, with all the facts before it, that the Pink Beds should be developed and should be developed as set out in the application of the City for water rights to the Forest Service of the Department of Agriculture.

The Asheville Citizen, under date of October 30, 1927, carried a large photograph of the proposed impounding reservoir in the Pink Beds, together with a front page news story, and on October 31, 1927, a comprehensive editorial endorsing the Pink Beds as a source of water supply and complimenting the Mayor and Commissioners of the City of Asheville in undertaking to develop this source of water supply. A similar editorial appeared in the Asheville Times on the same day.

Mr. Waldo Smith, in his affidavit in the case of S. D. Hall et al versus City of Asheville et al, heard before McElroy, Judge, has this to say with reference to the Pink Beds:

"From what I have seen in what may be called the Pisgah District thirty or forty miles southwest of Asheville, there are numbers of creeks and streams, the water of which is excellent in every way, much of it fully equal to that now obtained in Bee Tree and North Fork. I have no fear whatever that from time to time as more water is required, sufficient water can be secured from this source, to be delivered either by gravity or pump, to afford the City an ample supply for an indefinite period. If sources like these, the South Fork of Mills River, Pink Beds and others, that are favorably situated can be economically preempted without the investment of too much money, I would think it highly desirable to do so. Even if this is not done and some of them are developed to supply other communities, I still think there is sufficient water in these regions to supply all who may look upon it as a favorable location." And continuing, Mr. Smith says:

"I can not too strongly impress upon you the seriousness of the situation. You are dealing with a commodity necessary to the very life of the people. Without an ample supply of water, your City can not develop. You have had a shortage of water three times in six years, the last one in 1925 very serious, and another such occurrence will seriously affect the fame which your City has acquired. Something must be done and done quickly to save the day."

Mr. Waddell says, in the same case, that in 1925 he made a signed report for the City of Asheville on the water system, which report contains the reports of other engineers and which is a bound volume bearing the number 112 and is hereby made a part of this affidavit; that the conclusions and recommendations in said report he now reiterates and reaffirms; that in the autumn of 1925, by the direction of Commissioner Conder he made application to the U. S. Forest Department for the Pink Beds watershed area.

An inspection of the records discloses that John R. Freeman, J. Waldo Smith, Chas. E. Waddell, H. L. Parker and J. L. Ludlow have all made reports relative to the merits of the Pink Beds as a source of water supply for the City of Asheville. The main question involved in the litigation referred to, in which all these affidavits were used, was the purchase of 4500 additional acres of land on the North Fork water shed. The city of Asheville did not know and its attorneys did not know and the affidavits of all the engineers did not disclose that the Burnett site, around which this land was being purchased as a watershed, was a low pressure proposition, or in the words of Mr. John R. Freeman, the Burnett site was lower than the present pipe line and before the water from it could be made available a new line would have to be constructed following the meanders of the Swannanoa River.

The North Fork land has been acquired and it, together with the Burnett site, will become available at some future date when it is feasible to build an outfall down the Swannanoa River into the industrial and lower elevations of the City of Asheville, provided the character of the land at the proposed site proves upon investigation, through core drilling and otherwise, to be a safe and suitable site for the construction



THE CITY OF
ASHEVILLE
COUNTY OF ASHEVILLE
NORTH CAROLINA
TOPOGRAPHIC MAP
PREPARED BY THE
U.S. GEOLOGICAL SURVEY
WASHINGTON, D.C.
1907

Plate XVIII

of an impounding reservoir. Such a development, however, would cost, according to Mr. Ludlow, from \$4,900,000 to \$5,000,000. This development would be much more expensive than the Pink Beds development and at the same time would not produce exceeding 8 billion gallons storage from a dam 155 feet above present stream bed and 1400 feet long, and a low pressure proposition at that, against 15 billion gallons for the Pink Beds, a high pressure storage—that is, water that will flow by gravity into your present reservoir and other reservoirs of even higher elevation.

UNIVERSITY OF KENTUCKY
LEXINGTON

College of Arts and Sciences
Department of Geology.

Bellevue Cottage, Sunset Drive,
Asheville, N. C., June 20, 1928.

The Howerton Engineering Company,
Asheville, N. C.

Dear Sirs:

At your request I have recently completed an examination of the Pink Beds as a proposed source of additional water supply for the City of Asheville.

My report on the same follows:

THE PINK BEDS AS A SOURCE OF WATER SUPPLY FOR ASHEVILLE, N. C.

The Pink Beds, a high level natural basin for the impounding of water, lies in an air line S. 35 degrees W. from Asheville, a distance of 19 miles as measured from Pack Square to the site of the proposed dam at the outlet of the Beds.

The name "Pink Beds" is of somewhat uncertain origin. The old residents in the vicinity are disposed to explain it as due to the former abundance in the region of the wild pink. This, they say, has now largely disappeared on account of a once disastrous forest fire which radically altered the original flora of the region. At present the undergrowth is characterized by a very tangled thicket of laurel (*Kalmia latifolia*), which these residents say was not formerly so prevalent.

One wonders, however, if in this these persons are not mistaken, and if after all it is the presence in former days, as now, of this same laurel with its pink blossoms which, to one looking down on this basin from the Pisgah Ridge when this laurel was in bloom, gave to it the name by which it has long been known.

From an examination of the contour map covering the region (Pisgah Quadrangle Sheet) it would appear that the basin was formerly excavated and drained by an extension southwestward of what is now Bradley Creek, a tributary of South Fork of Mills River. By the headward cutting of the South Fork of Mills River, itself, this Old Bradley Creek was tapped and beheaded near where the weir for the measuring of the water output of the basin is located. Just below this point the present stream draining the Beds makes a sharp right angle bend and flows through a narrow gorge with precipitous fall. The gap between the present head of Bradley Creek and Thompson Creek, tributary of South Fork within the Pink Beds, is a relatively low one with reference to the surrounding mountains, the elevation above tide being 3365 feet. The elevation of the present outlet of the basin near the water gauge weir is about 3150 A. T., so since the time when Bradley Creek drained the area there has been a lowering of the valley floor by about 200 feet. This has taken place since the tapping of the basin by the head of South Fork of Mills River. After beheading Old Bradley Creek, the extension of South Fork of Mills River was itself beheaded by the headward erosion of Looking Glass Creek. The point of tapping being indicated by a sharp right angle bend in the course of the latter creek. The gap between the waters of this Creek and those of the South Fork in the Pink Beds is 3276 feet A. T. We have then the Pink Beds Basin inclosed on the sides by high mountains—those on the northwest side being the Pisgah Ridge—and at the two ends by low gaps or cols. The total length of this natural basin at floor level is about three and one half miles and its average width about one mile.

The site of the proposed dam to impound the water in this natural basin is near the narrow gorge about one fourth mile below the outlet of it at the water gauge weir. The elevation of the bed of the stream is here 3133 feet A. T. This will permit of a "V" shaped dam, 143 feet high as measured above the stream bed, being constructed before the water impounded in the basin would begin to spill over into Looking Glass Creek.

The height of the water level at this elevation—3276 feet A. T.—would be ample to furnish a static pressure sufficient to force water in the Asheville mains to all of the city and outlying suburbs—even to the top of Sunset Mountain Ridge, which at its highest points does not much exceed 3100 feet.

GEOLOGY OF THE PINK BEDS.

The basin of the Beds proper is underlain by Whiteside Granite, a name given to it by Arthur Kieth, geologist of the United States Geological Survey, who reported on the geology of Western North Carolina for this organization in the folios issued by it.

The outcrop of this formation, which here constitutes an elongated oval almost conterminous with the Pink Beds, is the furthest north of any other outcrop of it yet mapped. This dome of granite, which was forced up from below in a molten condition while the whole region was deeply covered by rocks, some of which still remain as the gneisses of Archean age constituting the prevalent formations of Western North Carolina, was exposed by the down cutting and also lateral erosion of both the Old Bradley Creek, and its successor in this region, the head of the South Fork. Being a relatively hard rock, when exposed it formed a local base level, on which these streams by side erosion excavated this flat bottomed high level valley.

The Whiteside Granite is here a somewhat coarse, highly feldspathic rock, unmarked by pronounced jointing, and on account of its intrusion into the region after most of the dynamic metamorphism was accomplished which formed the old gneisses (Arthur Kieth is inclined to place the intrusion as late as the Carboniferous Period) it shows no sign of schistosity. For this reason it should make an admirable floor for a reservoir of water.

The basin is surrounded, for the most part at a higher level, by Carolina and Roan Gneisses which form the inclosing mountains. The line of contact between the gneisses and this granite is, therefore, generally so high above the valley floor (only at the outlet does it fall below it) that there is no likelihood of there being any leakage of water by seepage alone schistosity planes.

The site of the proposed impounding dam, near the head of the narrow gorge forming the outlet to the basin is on Carolina Gneiss, here with its bedding and schistosity planes dipping steeply up stream.

Due to the rapid erosion of the stream the rock has been stripped of all debris in the bed of the stream itself. Also on account of the steepness of the slopes in the narrow gorge the overburden of decayed rock is very thin on them, it having slipped down hill almost as fast as formed and having been removed by the stream.

Carolina Gneiss is a very hard and firm rock where exposed by removal of the overburden of decayed materials. It is the rock quarried for construction purposes in Asheville and vicinity. Its decomposition to great depths wherever it forms the basement rock in Western North Carolina is no indictment of its qualities as a building or foundation stone. No rock can forever withstand the tooth of time, and this rock has been subjected to the weathering agencies in this region for an enormously long period—longer than the human period on this earth—and any freshly exposed rock of this formation will doubtless retain its integrity as such for as long a time as the race is likely to persist on the earth.

The solid Carolina Gneiss, then, will be exposed at comparatively shallow depths where it is proposed to construct the dam and will furnish a firm anchorage for it. The dip of the bedding planes is up stream at this site and will insure that there will be no leakage at bottom or sides of the dam along these planes.

The crushing strength of the gneiss is far above that required to support the weight of the dam at the greatest height to which it is proposed to construct it.

Altogether it would seem that it would be impossible to obtain anywhere in Western North Carolina a more ideal location for a reservoir of city water than that offered by the Pink Beds Basin of the Pisgah Forest Region.

Respectfully submitted,

(Signed) ARTHUR M. MILLER,
*Professor Emeritus of Geology,
University of Kentucky,
Lexington, Ky.*

WHO'S WHO OF AMERICA

1927.

Miller, Arthur McQuiston, Geologist, Eaton, Ohio, August 6, 1861;

U. of Worcester, 1880-82; A. B. Princeton, 1884, A. M., 1887; studied U. of Munich 1891-92; unmarried Prin. schs. Morning Sun., O., 1884-85. Prin. High Sch. Eaton, O., 1888-89; Prof. Natural History, Wilson Coll., Chambersburg, Pa., 1889-91; Prof. Geology U. of Ky. since 1892; also, dean Coll. Arts and Sciences; resigned deanship 1917 and granted leave of absence as consulting and field geologist, Federal Oil Co., June 1917-June, 1918; retired as Prof. emeritus of geology June 30, 1925. Fellow Geol. Sec. America A.A.A.S., Sigma Chi, Democrat, Presbyn. Wrote: The Lead and Zinc Bearing Rocks of Central Kentucky, 1905; Coals of Western Border of Eastern Coal Field in Kentucky, 1910; Geology of the Georgetown Quadrangle, 1913; Geology of Kentucky, 1919; Geology of Woodford Co., 1925. (All pub. by Ky. Geol. Survey).

Home: 609 S. Limestone St., Lexington, Ky.

(Editorial Asheville Times—Oct. 31, 1927)

THE PINK BEDS WATERSHED.

As the Pink Beds watershed program takes shape, it appears all the more worthy of the arduous efforts that have been expended to make this great natural basin a source of the city's water supply.

The lake itself, construction of which will begin in the near future, will be one of the show places of Western North Carolina. And the capacity of the watershed—there all Buncombe County will find the solution to solve a problem that has at times in the past been somewhat acute.

It is a gigantic enterprise and will call for an expenditure of approximately \$3,000,000. But its completion will give to Asheville and the surrounding territory that assurance against water famine without which there could never be freedom from anxiety for those who push forward either urban or suburban developments.

All Buncombe County welcomes the assurance from the City Administration that the work on this big project is to be carried on without delay.

The general sense of satisfaction in the minds of the people as they contemplate the Pink Beds development as a thing of beauty and of utility should not, however, cause forgetfulness of two important matters related to the larger Asheville of the future. 1. Water must be made to flow freely, through more ample mains, wherever it may be needed. 2. The suburbs under consideration in the annexation program should take a larger view of that question than can be had merely from technical discussion of advantages and disadvantages.

The Asheville community should be one, in spirit and as a legal entity. Coming into the city limits is not merely a question of securing city rights of fire and police protection, or of being relieved of double water rates.

If Asheville is worth living near, if Asheville's destiny affects all on the outskirts of the city, then the people now outside, in those localities which are logically a part of the city proper, should look upon full citizenship in the mother city as an acceptance of larger privileges as well as the assumption of certain larger responsibilities.

In other words, whatever will make the city of Asheville a better place in which to live, in which to build a home and to surround children with desirable environments—these considerations should appeal to all who are now intimately connected with Asheville's daily life, though they may live beyond the city limits.

(Editorial Asheville Citizen—Oct. 31, 1927)

WATER FROM THE PINK BEDS

Asheville has had few strokes of fortune for which it had so much cause to be grateful as for the fact that the scheme for creating a huge water supply for the City and for Buncombe County in the Pink Beds of Pisgah National Forest has been approved and that the project has the support and endorsement of the Federal government and of the forestry officials.

This solves the question of an adequate water supply for the city and county for many a year to come; and solves it ideally. A water reserve of fifteen billion gallons will be created and the water will be as pure as can be found the world over. Supplementing the city's existing water supply this will mean that the needs of Asheville and the needs of Buncombe County will be taken care of under all conditions and will provide for the increasing requirements that can be expected as we grow in population and in industries.

But the Pink Beds project will do more than this. It will create on the other side of Asheville still another mountain lake which should be one of the loveliest beauty spots in Eastern America. Visitors to Mount Pisgah will see it stretched out below them, a vision of surpassing beauty.

The Pink Beds of Pisgah Forest get their name from a pink flower which grows there in great profusion. The beds themselves are the basin of what, we are told, was at some remote period in the past a mountain lake, formed in this huge basin which lies between two mountain ridges. The water in the lake broke through one of the ridges long ago and formed what is now Mills River. The artificial lake which will be created for the water supply will be fed by a number of small mountain streams and the water will be as clear as crystal and as pure as the brooks that feed the fifteen billion gallon reserve.

The Pink Beds water supply will cost a good deal of money, some \$4,000,000 it is estimated, but the city and county are in position to finance the undertaking and the creation of such a water supply meets present demands and guarantees future development. We have every reason to be profoundly thankful to the Federal government and to Forestry officials for the broad and liberal cooperation they have given in this matter. Only with this cooperation could an undertaking of this kind have been worked out for the cost of securing such a water shed and such a water reserve would have been prohibitive otherwise.

With many things that inspire faith in the future, the assurance that the success of the Pink Beds project is now definitely in sight must be put at the top of the list. Its importance cannot be exaggerated.

CONCLUSIONS AND RECOMMENDATIONS.

From the information contained herein, we conclude:

1.

That the South Mills River or Pink Beds area will supply the greatest maximum amount of water at the lowest cost per million gallons.

2.

The first, second and third units, as set out herein, will provide 30 M. G. D. at a cost of \$5,074,-482.01, or \$169,100.00 per M. G., distributed over the development as follows:

(a) The first unit consisting of sections 1-2-3-4 and 5 or the Intake, 1-30" C. I. main, Frady Mt. Reservoir, and 1-24" Distribution Line to Asheville, will provide at Asheville 13.4 M. G. D. subject to runoff fluctuations at a cost of \$2,025,137.22, or \$151,100.00 per M. G.

(b) The second unit consisting of sections 6, 7 and 8, or the Impounding Dam, Reservoir and Roadway will cost \$1,549,735.25 and, together with the 1st unit, will provide at Asheville a constant delivery of 15 M. G. D. at a total cost for both units of \$3,574,872.47, or \$238,300.00 per M. G.

(c) The third unit consisting of a 2nd pipe line from the Intake to Asheville (probably 30" from the Intake to the Frady Mt. Distribution Reservoir, and 20" from there to Asheville), will cost \$1,499,-609.54, and together with units 1 and 2 will provide at Asheville a constant delivery of 30 M. G. D. at a total cost for the 3 units of \$5,074,482.01 or \$169,100.00 per M. G.

3.

The South Mills River or Pink Beds area of the Pisgah National Forest will supply a greater quantity of excellent water suitable for domestic consumption than any other area in this region—45 M. G. D. high pressure supply and an additional 15 M. G. D. low pressure supply—providing 60 M. G. D. in 1927. That is to say, the upper reaches of the South Fork of Mills River provided during the years 1926, 1927 and the 1st 5 months of 1928 an average daily runoff of 1.77 M. G. per square mile against 1.41 M. G. per square mile for the North Fork area above the measuring weir which is situated below the Burnett dam site. The South Mills River or Pink Beds area during July, August, September and October of 1927, measured at the weir situated above the proposed dam site, provided a daily runoff of .88 M. G. per square mile against .39 M. G. per square mile for North Fork. Mills River at the proposed intake supplied 14.1 M. G. D. through the foregoing period, as against 6.2 M. G. D. from an area the same size on the North Fork of the Swannanoa River.

4.

It is not economical to develop the North Fork of the Swannanoa River as a high pressure source of water supply for the reason that the cost is and would be excessive. To realize any practical benefits from the further development of the North Fork area as a high pressure source of supply, a dam must be built—provided, of course, that a suitable foundation could be found for the location of such a dam in the vicinity of the so-called Burnett site—at a cost of \$2,750,000.00. This embraces an earthen dam 155 feet in height above ground and 1400 feet in length and, in addition to this dam, it would be necessary to build a dyke and remove the bodies from an old established cemetery or country graveyard on account of the flooding of this graveyard with back water, together with the further additional cost of a 30" cast iron pipe line which would amount to \$1,275,000.00. These items, together with other incident items necessarily entering into the cost of this project, would make the cost of creating this artificial water level of 155 feet above normal, in excess of \$5,000,000.00 for the completed project. This conclusion as to the cost of this earthen dam is taken from the report of J. L. Ludlow, but in our opinion we think the cost would exceed the

cost given in the Ludlow Report, for the certain reason that excavation for dam would vary from 25 to 75 feet making the extreme height of dam from 180 to 230 feet, but figured on the basis of this minimum cost, the cost per M. G. amounts to \$416,600 based on a supply of 12 M. G. D.

An earthen dam 125 feet above stream bed at this location, coupled with a 30" cast iron supply line, based on the figures of J. L. Ludlow for the cost of the dam, would exceed \$3,175,000.00, for 11 M. G. D. delivery making a cost of \$289,000.00 per M. G., which is prohibitive at this time as a high pressure system. Our investigation and the investigations made by the officials of the City of Asheville and the readings of the meter disclose that, without the impounding dam, during the dry period of each year, the supply would be so small as to render it worthless at the time when the demand for water would be the greatest. In short, our investigations and the experience of the City of Asheville disclose that the intake, in the absence of the impounding dam, would be worthless either as a low or high pressure source of water supply and that the cost would be excessive as a high pressure source of supply even if the impounding dam were built. The needs of Asheville at the present can only be met by an adequate high pressure water system. Therefore, the development of the North Fork as a low pressure supply would be inadvisable at this time.

5.

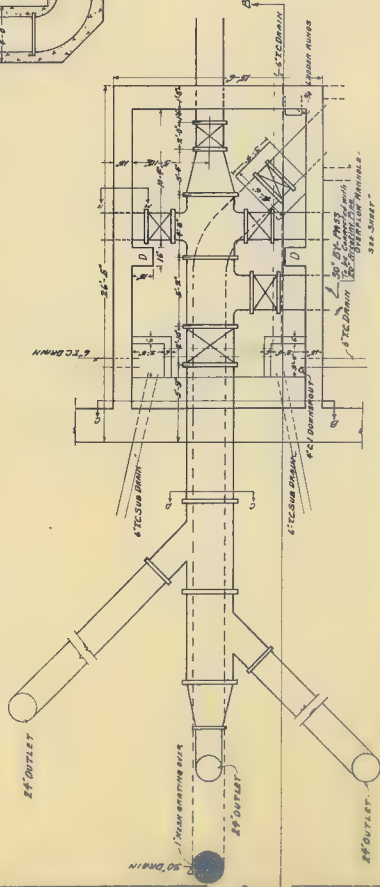
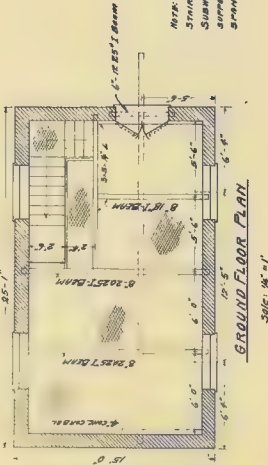
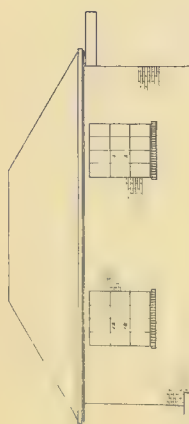
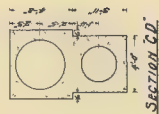
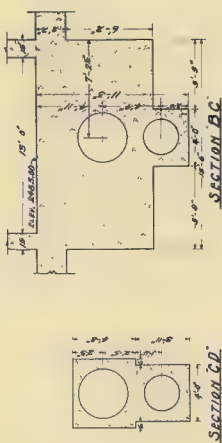
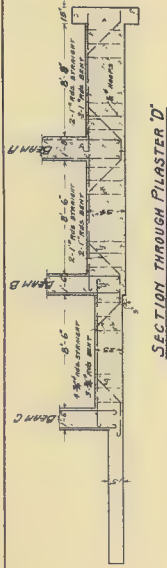
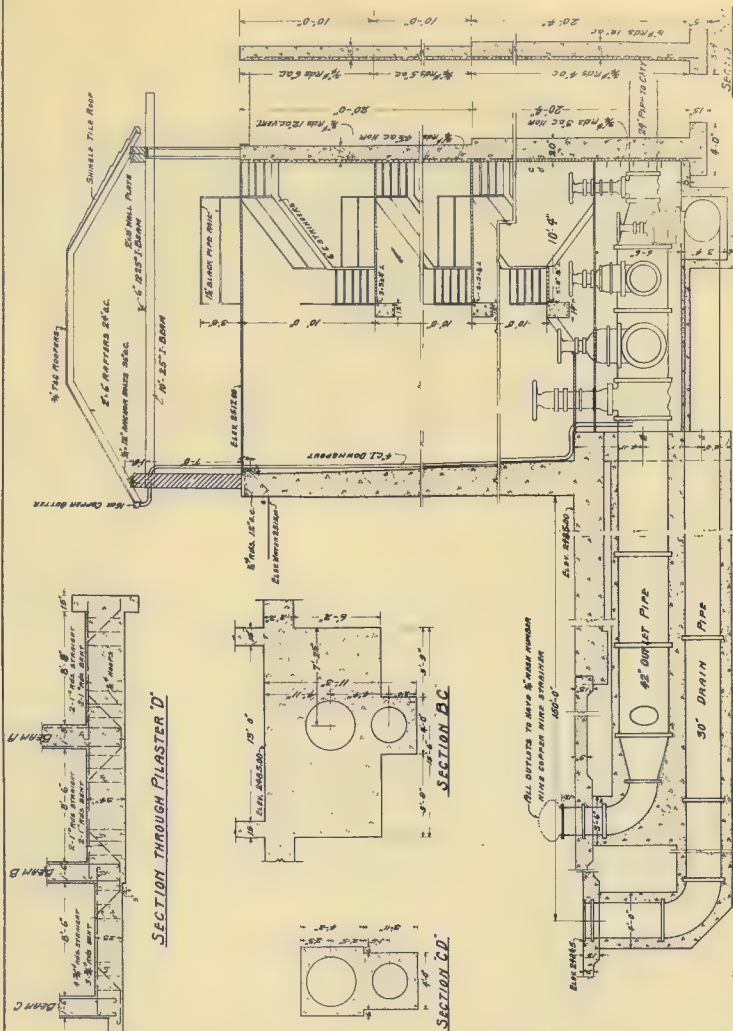
The Pink Beds area or the South Fork of Mills River in the Pisgah National Forest, providing 60 M. G. D., is available to the City of Asheville without the purchase of an acre of land and is policed by the U. S. Government. This area is heavily wooded and, therefore, the water in the streams is clear and free from suspended matter, which pollutes those water courses, traversing more open country.

6.

The Forestry Department of the U. S. Department of Agriculture and the Department of Agriculture, after a complete investigation, with the aid of Government Engineers, of the Bee Tree, North Fork and the South Mills River watersheds, found as a fact that the City of Asheville is in immediate need of the Pink Beds area as a source of water supply and has authorized the City of Asheville to make this survey preparatory to the issuance of a permit for its development by the City of Asheville as a permanent source of water supply.

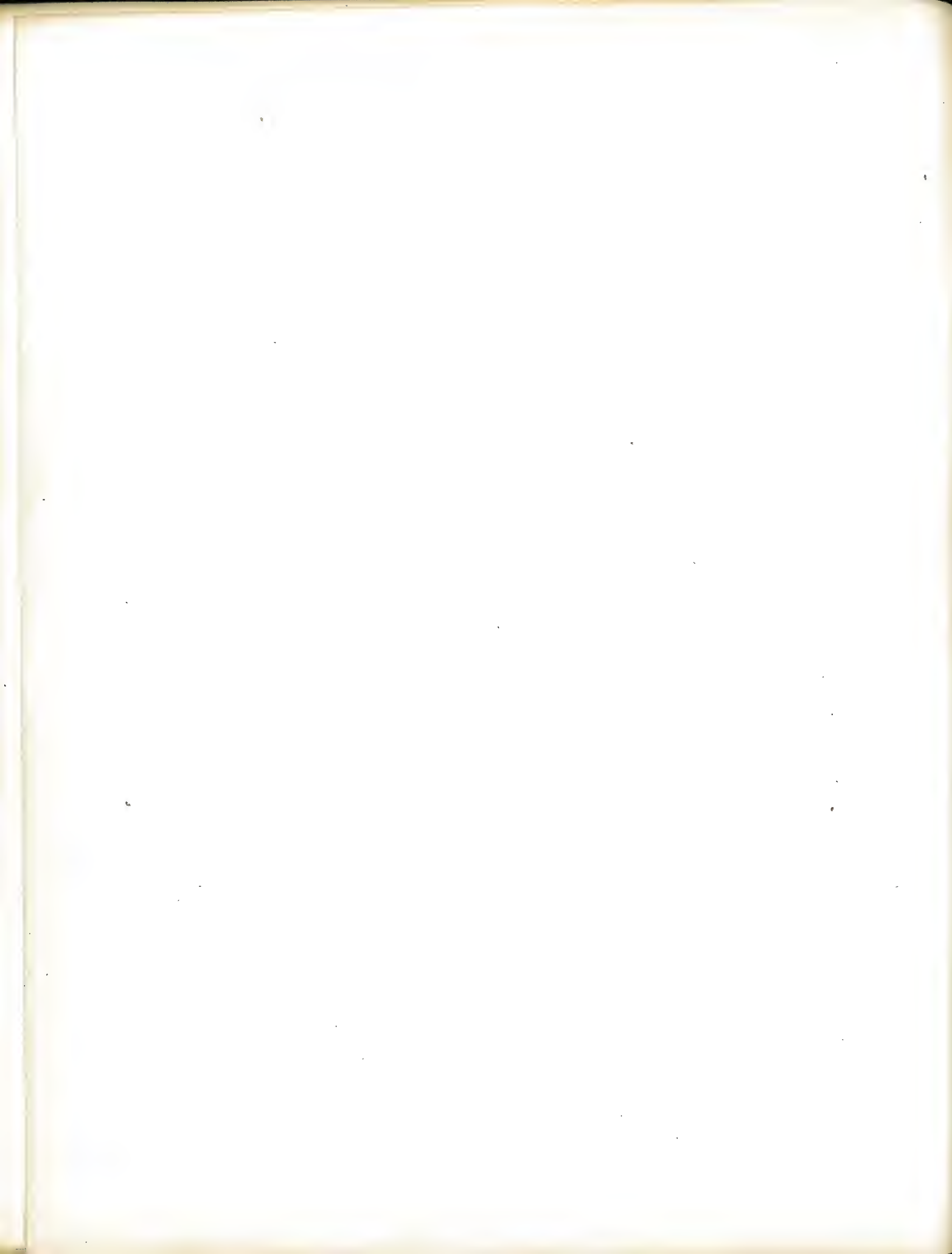
Since the year 1919, or for different periods during the past ten years, the City of Asheville has suffered seriously and almost disastrously on account of severe droughts. This is especially true of the years 1925 and 1926. In an effort to meet this shortage and to avert an almost certain calamity such as threatened in 1925, the development of the Bee Tree watershed was undertaken by the City of Asheville at a cost of \$2,159,000.00, up to the year 1927. Something in excess of \$12,000.00 has been spent in the last year on the project. A substantial amount was spent on the pumping plant at Lake View, and on the pumping plant at Asheville School Estate and the present filter plant situated on the French Broad River near Biltmore House was constructed, together with the pipe lines connecting it with the City mains, at an aggregate cost in excess of \$162,000.00. In addition to the three pump lines that have been established on the North Fork of the Swannanoa River, Sugar Fork was diverted into the present 16" North Fork line, together with Long Branch into the Bee Tree line, resulting in thousands of dollars of expenditure on account of our unpreparedness at times of minimum flow in severe drought, as will appear from the vouchers and itemized statements now on file in the office of the Secretary-Treasurer of the City of Asheville, part of which are hereto attached for your convenience and information.

The Waddell Report 112, page 39, stated that the Bee Tree impounding dam will provide a continuous delivery of 7 M. G. D. Assuming that this increases the permanent supply by 6 M. G. D., then the cost is \$359,800.00 per M. G. This is giving the 16" line, which was laid before the impounding reservoir was built, credit for carrying only 1 M. G. D. of water, during dry season, but if it carried more, then the cost per M. G. of the Bee Tree dam is increased in like ratio.



HIGH PRESSURE
GRAVITY WATER SUPPLY
CITY OF ASHEVILLE
BUNCOMBE COUNTY - N.C.
FROM
PISGAH NATIONAL FOREST
DISTRIBUTION RESERVOIR
OUTLET GATE HOUSE
SCALE: 1"=1'
MAY 21 1928
HOWENTON ENGINEERING Co.
ENGINEERS
ASHEVILLE, N.C.
DRAWING No. W-46 SHEET No. 24

PLAN OF RESERVOIR OUTLET GATE HOUSE



9.

Many large industrial interests have been kept away from Asheville, and are at this time being kept away from Asheville and vicinity, on account of the lack of sufficient City water supply. This has been, to all appearances, a season of adequate rainfall. We are more than two inches, however, behind normal, but despite the apparently abundant rainfall, the meter of the City of Asheville metering the water of Bee Tree Creek above the dam, on Thursday, July 19, 1928, showed that this entire watershed was furnishing only 2 M. G. D. of water.

10.

The development of the Pink Beds area in the Pisgah National Forest as a source of water supply would as a matter of course be extended over a period of approximately four years as to both construction and financing.

We, therefore, recommend in the light of the facts relative to the increase of Asheville's water supply, and the imperative need to so increase the same at once, that the Pink Beds area of the Pisgah National Forest be developed immediately in a manner as follows:

(a) Unit 1, page No. 10, consisting of the construction of intake on the South Fork of Mills River above McCall Mountain and the McCall Mountain Tunnel, the laying of a 42" cast iron pipe line from the intake down to and through the tunnel, the laying of a 30" cast iron pipe from the lower portal of said tunnel to the proposed distribution reservoir site on Frady Mountain near Busbee, the construction of said reservoir, the laying of the 24" distribution pipe line from this reservoir into Asheville and on to Deaver View, beyond the western limits of the City, and the construction of the Deaver View reservoir—all as shown in this report.

And in addition the clearing and grubbing of the area to be flooded by the proposed impounding reservoir in the Pink Beds.

(b) The construction of the dam immediately upon the completion of the work to be done under (a), according to the detailed plans and specifications submitted herewith.

(c) Units three, four and five to be begun and completed as the demands of the City increase, thus necessitating the further development of the project to its full capacity.

Respectfully submitted,

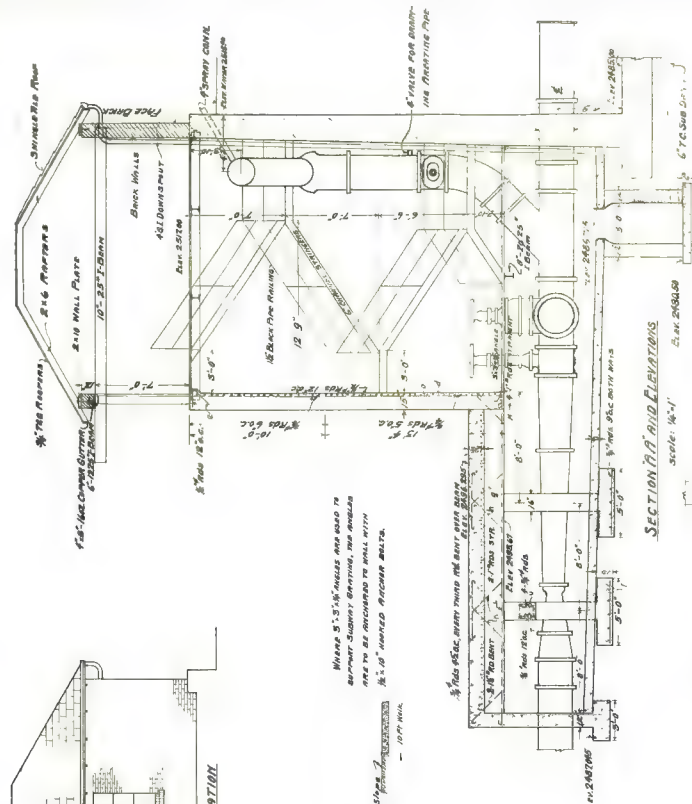
HOWERTON ENGINEERING CO.

By H. M. Howerton

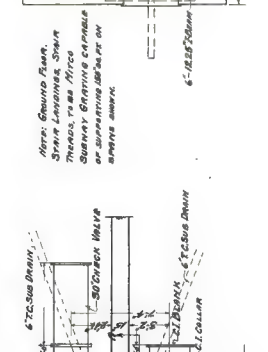
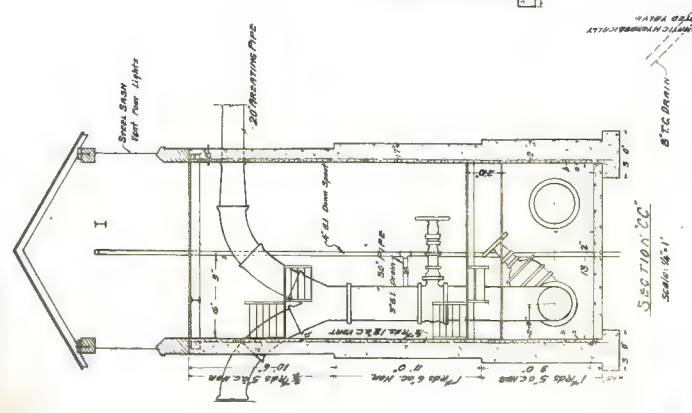
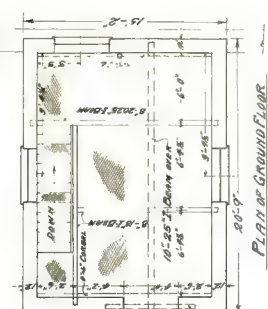
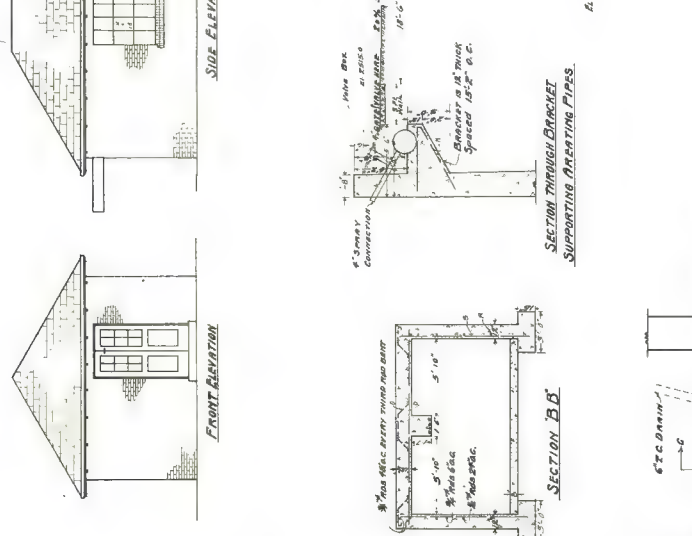
QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	* By Pumping	By Gravity							
Jan.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15	2.91		9.05	11.96	11.4				
16	2.91		8.40	11.31	10.8				
17	2.91		95.0	97.91	93.5				
18	2.91		503.	505.91	483.1				
19	2.91		95.0	97.91	93.5				
20	2.91		55.5	58.41	55.8				
21	2.91		41.9	44.81	42.8				
22	2.91		41.9	44.81	42.8				
23	2.91		32.3	35.21	33.6				
24	2.91		28.4	31.31	29.9				
25	2.91		25.2	28.11	26.9				
26	2.91		21.3	24.21	23.2				
27	2.91		18.1	21.01	20.0				
28	2.91		16.1	19.01	18.2				
29	2.91		14.2	17.11	16.3				
30	2.91		12.9	15.81	15.1				
31	2.91		23.3	26.21	25.0				
Total	49.47		1041.5	1091.0	1041.9				
Average			61.4	64.3	61.4				
Maximum			503.0	505.9	483.1				
Minimum			8.40	11.31	11.42				

*Amount shown in this column represents total amount diverted to City as shown in Ludlow's Report.



**HIGH PRESSURE
GRAVITY WATER SUPPLY
CITY OF ASHEVILLE**
FROM
BUNCOMBE COUNTY - N.C.
**PISGAH NATIONAL FOREST
DISTRIBUTION RESERVOIR
INLET GATE HOUSE**
SCALE: 1/4"=1'
MAY 24 1928
HOWERTON ENGINEERING CO.
ASHEVILLE, N.C.
DRAWING NO. W-446 SHEET No. 23



QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping *	By Gravity							
Feb.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	2.91		25.8	28.7	27.4				
2	2.91		21.9	24.8	23.7				
3	2.91		35.5	38.4	36.7				
4	2.91		33.6	36.5	34.9				
5	2.91		27.1	30.0	28.6				
6	2.91		25.8	28.7	27.4				
7	2.91		24.5	27.4	26.2				
8	2.91		23.2	26.1	25.0				
9	2.91		22.6	25.5	24.4				
10	2.91		21.3	24.2	23.1				
11	2.97		18.1	21.1	20.1				
12	2.97		17.4	20.4	19.5				
13	2.91		17.4	20.3	19.4				
14	2.97		24.5	27.5	26.3				
15	2.97		26.4	29.4	28.1				
16	2.97		21.3	24.3	23.2				
17	2.97		18.7	21.7	20.7				
18	2.97		21.9	24.9	23.8				
19	3.03		53.0	56.0	53.5				
20	3.03		42.0	45.0	43.0				
21	2.97		33.6	36.6	35.0				
22	3.03		31.0	34.0	32.5				
23	3.03		27.1	30.1	28.8				
24	3.03		23.2	26.2	25.0				
25	3.03		47.8	50.8	48.5	54.9	86.2	97.0	121.1
26	3.03		38.8	41.8	39.9	38.1	59.9	67.5	84.4
27	3.03		31.6	34.6	33.0	33.6	52.8	59.4	74.4
28	3.03		28.4	31.4	30.0	29.7	46.6	52.5	65.7
Total	83.04		783.5	866.4	827.7	156.3	245.5	276.4	345.6
Average			28.0	31.0	29.6	39.1	61.5	69.1	86.4
Maximum			53.0	56.0	53.5	54.9	86.2	97.0	121.1
Minimum			17.4	20.3	19.4	29.7	46.6	52.5	65.7

*Amount shown in this column represents total amount diverted to City as shown in Ludlow's Report.

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	* By Pumping	By Gravity							
March	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	2.97		27.8	30.8	29.4	27.1	42.5	47.9	59.9
2	3.03		27.8	30.8	29.4	27.1	42.5	47.9	59.9
3	2.58		23.9	26.5	25.3	25.8	40.5	45.6	57.1
4	2.97		22.6	25.6	24.5	22.6	35.5	40.0	50.1
5	2.97		21.3	24.3	23.2	22.0	34.5	38.9	48.6
6	2.97		20.0	23.0	22.0	20.7	32.5	36.6	45.8
7	2.97		37.4	40.4	38.6	44.6	70.0	79.0	98.6
8	2.97		34.2	37.2	35.5	31.0	48.7	54.8	68.5
9	2.97		27.8	30.8	29.4	26.5	41.6	46.9	58.6
10	2.97		25.2	28.2	26.9	24.6	38.7	43.5	54.5
11	2.97		25.8	28.8	27.5	24.6	38.7	43.5	54.5
12	2.97		23.2	26.2	25.0	23.9	37.5	42.2	52.9
13	2.97		22.0	25.0	23.9	25.2	39.6	44.6	55.7
14	2.97		20.0	23.0	22.0	22.6	35.5	40.0	50.1
15	2.97		19.4	22.4	21.4	22.6	35.5	40.0	50.1
16	2.91		18.1	21.1	20.2	20.0	31.4	35.3	44.3
17	2.91		18.1	21.1	20.2	18.7	29.4	33.0	41.3
18	2.91		20.0	23.0	22.0	19.4	30.4	34.3	42.9
19	2.97		23.9	26.9	25.7	18.7	29.4	33.1	41.3
20	2.97		30.3	33.3	31.8	18.7	29.4	33.1	41.3
21	2.97		33.6	36.6	35.0	17.5	27.4	30.9	38.7
22	2.97		30.3	33.3	31.8	16.2	25.4	28.7	35.8
23	2.97		33.6	36.6	35.0	20.0	31.4	35.3	44.3
24	2.91		31.6	34.6	33.1	16.2	25.4	28.6	35.8
25	2.97		29.0	32.0	30.6	16.2	25.4	28.6	35.8
26	2.97		31.0	34.0	32.5	16.8	26.4	29.7	37.2
27	2.97		27.8	30.8	29.4	15.5	24.3	27.4	34.3
28	2.97		25.2	28.2	26.9	14.9	23.4	26.3	32.9
29	2.97		23.2	26.2	25.0	14.2	22.3	25.2	31.4
30	2.97		23.2	26.2	25.0	18.1	28.4	32.0	40.0
31	2.97		86.5	89.5	85.5	34.2	53.7	60.5	75.6
Total	91.50		863.8	956.4	913.70	686.2	1077.3	1213.4	1517.8
Average			27.8	30.9	29.5	22.1	34.7	39.2	48.9
Maximum			37.4	40.4	38.6	44.6	70.0	79.0	98.6
Minimum			18.1	21.1	20.2	14.2	22.3	25.2	31.4

*Amount shown in this column represents total amount diverted to City as shown in Ludlow's Report.

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping *	By Gravity							
April	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	2.97		45.2	48.2	46.0	25.2	39.6	44.5	55.7
2	2.97		36.8	39.8	38.0	22.0	34.5	38.9	48.6
3	2.97		32.3	35.3	33.7	20.7	32.5	36.7	45.9
4	2.97		29.0	32.0	30.6	18.7	29.4	33.1	41.3
5	2.97		25.8	28.8	27.5	17.5	27.4	30.9	38.7
6	2.97		23.9	26.9	25.7	16.2	25.4	28.6	35.8
7	2.97		24.5	27.5	26.3	29.8	46.8	52.7	65.9
8	2.97		71.0	74.0	70.7	62.7	98.4	111.1	138.7
9	2.97		48.4	51.4	49.2	38.8	60.9	68.6	85.8
10	2.97		37.5	40.5	38.7	31.0	48.7	54.8	68.5
11	2.97		41.3	44.3	42.3	34.2	53.7	60.5	75.6
12	2.97		38.7	41.7	39.9	29.8	46.8	52.7	65.9
13	2.97		43.2	46.2	44.2	33.6	52.8	59.5	74.4
14	2.97		36.8	39.8	38.0	29.8	46.8	52.7	65.9
15	1.94		33.6	35.5	33.9	28.4	44.6	50.2	62.8
16	1.29		32.3	33.6	32.1	27.1	42.5	47.9	59.9
17	.64		28.4	29.0	27.7	26.5	41.6	46.9	58.6
18	2.91		25.8	28.7	27.4	25.2	39.6	44.6	55.7
19	3.04		23.9	26.9	25.7	24.6	38.7	43.5	54.5
20	2.97		21.3	24.3	23.2	23.3	36.6	41.2	51.6
21	3.04		20.0	23.0	22.0	21.3	33.5	37.7	47.1
22	3.10		18.7	21.8	20.8	19.4	30.5	34.3	42.9
23	3.10		21.9	25.0	23.9	18.1	28.4	32.0	40.0
24	3.10		19.4	22.5	21.5	16.8	26.4	29.7	37.2
25	3.10		18.1	21.2	20.3	16.2	25.4	28.6	35.8
26	3.10		16.8	19.9	19.0	15.5	24.3	27.4	34.3
27	2.26		16.8	19.1	18.2	15.5	24.3	27.4	34.3
28	2.71		16.1	18.8	18.0	14.9	23.4	26.3	32.9
29	2.00		14.8	16.8	16.1	14.2	22.3	25.2	31.4
30	1.48		13.6	15.1	14.4	13.6	21.3	24.0	30.1
Total	81.36		875.9	957.6	915.0	730.6	1147.1	1292.2	1615.8
Average			29.2	31.9	30.5	24.4	38.2	43.1	53.9
Maximum			71.0	74.0	70.7	62.7	98.4	111.1	138.7
Minimum			13.6	15.1	14.4	13.6	21.3	24.0	30.1

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QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping *	By Gravity							
May	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	3.10		12.9	16.0	15.3	13.6	21.3	24.0	30.1
2	3.10		12.9	16.0	15.3	13.6	21.3	24.0	30.1
3	3.10		12.3	15.4	14.7	12.9	20.2	22.8	28.5
4	3.03		11.6	14.6	13.9	12.3	19.3	21.8	27.2
5	3.03		11.6	14.6	13.9	12.3	19.3	21.8	27.2
6	3.03		10.3	13.3	12.7	12.3	19.3	21.8	27.2
7	2.97		10.3	13.3	12.7	12.3	19.3	21.8	27.2
8	3.03		9.7	12.7	12.1	12.9	20.2	22.8	28.5
9	3.03		9.7	12.7	12.1	12.9	20.2	22.8	28.5
10	3.03		10.3	13.3	12.7	12.3	19.3	21.8	27.2
11	3.03		11.0	14.0	13.4	14.9	23.4	26.4	32.9
12	3.03		11.6	14.6	13.9	15.5	24.3	27.4	34.3
13	3.03		10.3	13.3	12.7	12.9	20.2	22.8	28.5
14	3.03		9.7	12.7	12.1	12.3	19.3	21.8	27.2
15	3.03		10.3	13.3	12.7	14.2	22.3	25.1	31.4
16	3.03		46.5	49.5	47.3	16.2	25.4	28.6	35.8
17	2.97		34.2	37.2	35.6	13.6	21.3	24.0	30.0
18	2.97		25.8	28.8	27.5	12.3	19.3	21.8	27.2
19	2.91		22.0	24.9	23.8	11.6	18.2	20.5	25.6
20	2.97		19.4	22.4	21.4	11.0	17.3	19.4	24.3
21	2.97		16.8	19.8	18.9	11.0	17.3	19.4	24.3
22	2.97		15.5	18.5	17.7	9.7	15.2	17.2	21.4
23	2.97		14.2	17.2	16.2	9.7	15.2	17.2	21.4
24	4.20		12.9	17.1	16.3	9.1	14.3	16.1	20.1
25	4.97		10.3	15.3	14.6	9.1	14.3	16.1	20.1
26	4.97		9.0	14.0	13.4	8.4	13.2	14.8	18.6
27	5.29		9.0	14.3	13.7	7.8	12.3	13.8	17.2
28	5.10		11.0	16.1	15.4	9.7	15.2	17.2	21.4
29	5.17		9.0	14.2	13.5	8.4	13.2	14.8	18.6
30	5.29		8.4	13.7	13.1	9.1	14.3	16.1	20.1
31	5.43		7.7	13.1	12.5	9.7	15.2	17.2	21.4
Total	109.78		436.2	545.9	521.1	363.6	570.4	643.1	803.5
Average			14.1	17.6	16.8	11.7	18.4	20.7	25.9
Maximum			46.5	49.5	47.3	16.2	25.4	28.6	35.8
Minimum			7.7	12.7	12.1	7.8	12.3	13.8	17.2

*Amount shown in this column represents total amount diverted to City as shown in Ludlow's Report.

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping *	By Gravity							
June	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	5.42		7.75	13.2	12.6	8.4	13.2	14.8	18.6
2	5.48		6.45	11.9	11.4	7.8	12.3	13.8	17.2
3	5.55		6.00	11.6	11.1	7.8	12.3	13.8	17.2
4	4.97		5.68	10.6	10.1	7.1	11.1	12.5	15.7
5	4.58		6.33	10.9	10.4	7.8	12.3	13.8	17.2
6	4.39		6.00	10.4	9.9	7.8	12.3	13.8	17.2
7	4.58		5.16	9.7	9.25	7.1	11.1	12.5	15.7
8	4.39		4.39	8.8	8.4	7.1	11.1	12.5	15.7
9	4.39		7.75	12.1	11.55	6.5	10.2	11.5	14.4
10	4.58		6.45	11.0	11.5	6.2	9.7	10.9	13.7
11	4.72		4.84	9.6	9.2	5.8	9.1	10.3	12.8
12	4.52		4.39	8.9	8.5	5.4	8.5	9.5	11.9
13	3.81		4.19	8.0	7.6	11.6	18.2	20.5	25.6
14	4.52		3.74	8.3	7.9	7.8	12.3	13.8	17.2
15	4.58		4.00	8.6	8.2	7.1	11.1	12.5	15.7
16	2.32		4.19	6.5	6.2	6.5	10.2	11.5	14.4
17	5.48		3.36	8.8	8.4	5.8	9.1	10.3	12.8
18	5.42		2.58	8.0	7.6	5.8	9.1	10.3	12.8
19	5.48		2.39	7.9	7.55	9.7	15.2	17.2	21.4
20	4.52		2.58	7.1	6.8	12.9	20.2	22.8	28.5
21	4.33		2.26	6.6	6.3	8.4	13.2	14.8	18.6
22	4.33		2.13	6.5	6.2	6.5	10.2	11.5	14.4
23	4.58		2.26	6.8	6.5	6.2	9.7	10.9	13.7
24	3.88		1.81	5.7	5.45	7.1	11.1	12.5	15.7
25	3.62		1.55	5.2	4.95	5.4	8.5	9.5	11.9
26	3.68		1.55	5.2	4.95	5.1	8.0	9.0	11.3
27	4.33		1.68	6.0	5.7	6.2	9.7	10.9	13.7
28	4.58		2.06	6.6	6.3	7.8	12.3	13.8	17.2
29	2.97		1.74	4.7	4.5	5.8	9.1	10.3	12.8
30	3.29		1.48	4.8	4.6	5.1	8.0	9.0	11.3
Total	133.29		116.74	250.0	239.6	215.6	338.4	380.8	476.3
Average			3.9	83.3	79.9	7.2	11.3	12.7	158.7
Maximum			7.7	13.2	12.6	12.9	20.2	22.8	28.5
Minimum			1.5	4.7	4.5	5.1	8.0	9.0	11.3

*Amount shown in this column represents total amount diverted to City as shown in Ludlow's Report.

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)±57.1%	Total Runoff at Cantrell Creek Intake (6)±76.9%	Total Runoff at Bradley Creek Intake (6)±121.1%
	By Pumping	By Gravity							
July	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	3.93		1.03	4.96	4.74	4.45	6.95	7.85	9.85
2	4.30		.97	5.27	5.03	4.00	6.30	7.08	8.85
3	4.64		1.03	5.67	5.42	4.20	6.60	7.42	9.30
4	4.85		1.61	6.46	6.17	5.03	7.89	8.89	11.13
5	3.31		1.74	5.05	4.83	5.42	8.45	9.58	12.00
6	4.13		1.74	5.87	5.61	13.56	21.26	23.96	29.96
7	2.91		1.61	4.52	4.32	7.75	12.15	13.70	17.15
8	4.15		.91	5.06	4.84	5.04	7.89	8.89	11.13
9	3.76		.57	4.33	4.13	4.46	6.96	7.86	9.85
10	3.49		.52	4.01	3.83	4.20	6.60	7.42	9.30
11	4.36		.57	4.93	4.71	3.75	5.89	6.63	8.30
12	3.42		.57	3.99	3.81	3.36	5.28	5.95	7.42
13	3.24		.52	3.76	3.59	3.36	5.28	5.95	7.42
14	3.07		.52	3.59	3.43	3.36	5.28	5.95	7.42
15	2.93		.57	3.50	3.33	3.10	4.88	5.49	6.85
16	2.78		.52	3.30	3.15	3.10	4.88	5.49	6.85
17	2.70		.52	3.22	3.08	2.91	4.57	5.15	6.43
18	2.51		.52	3.03	2.89	2.91	4.57	5.15	6.43
19	2.49		.47	2.96	2.83	2.65	4.17	4.69	5.85
20	1.98	2.40	.47	4.85	4.63	2.46	3.87	4.36	5.44
21	.86	1.50	.52	2.88	2.75	2.26	3.55	4.00	5.00
22	.56	2.00	.61	3.17	3.03	2.46	3.87	4.36	5.44
23	2.58		.66	3.24	3.10	9.04	14.19	15.96	20.00
24	2.58		.66	3.24	3.10	3.75	5.89	6.63	8.30
25	1.29	1.20	.66	3.15	3.01	3.75	5.89	6.63	8.30
26	.48	2.11	.66	3.25	3.11	8.40	13.20	14.85	18.60
27	2.98	1.12	1.03	5.13	4.90	9.04	14.19	15.96	20.00
28	4.32		5.68	10.05	9.60	23.25	36.55	41.05	51.50
29	4.65		96.25	100.90	96.4	37.50	58.9	66.40	83.00
30	5.01		137.0	142.0	135.6	51.00	80.0	90.20	112.80
31	5.01		38.1	43.1	41.2	27.80	43.6	49.20	61.40
Total	99.27	10.33	298.8	408.4	390.2	267.3	419.5	472.7	591.27
Average			9.63	13.2	12.6	8.6	13.5	15.2	19.0
Maximum			137.0	142.0	135.6	51.0	80.0	90.20	112.80
Minimum			0.47	2.88	2.75	2.26	3.55	4.0	5.00

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
August	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	4.21		38.1	42.3	40.4	27.1	42.5	47.9	59.9
2	5.46		32.3	37.8	36.1	31.0	48.7	54.8	68.5
3	5.14		21.3	26.4	25.2	27.8	43.6	49.2	61.4
4	5.50		14.8	20.3	19.4	20.7	32.5	36.7	45.8
5	5.48		12.3	17.8	17.0	18.8	29.5	33.3	41.5
6	5.53		9.9	15.4	14.7	16.1	25.2	28.5	35.6
7	5.13		9.7	14.8	14.1	12.3	19.3	21.7	27.2
8	5.36		8.9	14.3	13.6	11.0	17.2	19.45	24.3
9	3.92		6.9	10.8	10.3	9.7	15.2	17.2	21.4
10	5.40		6.0	11.4	10.9	9.0	14.1	15.9	19.9
11	5.48		14.8	20.3	19.4	7.75	12.17	13.70	17.15
12	1.88	3.0	18.7	23.6	22.6	9.0	14.1	15.9	19.9
13	.01	3.0	12.9	15.9	15.2	13.6	21.3	24.1	30.1
14		3.0	10.4	13.4	12.8	10.0	15.7	17.7	22.1
15		3.0	8.2	11.2	10.7	7.8	12.3	13.8	17.2
16		3.0	6.5	9.5	9.1	6.9	10.84	12.2	15.25
17		3.0	8.0	11.0	10.5	8.0	12.06	14.1	17.7
18	3.8		10.7	14.5	13.9	6.5	10.2	11.5	14.4
19	4.12		9.1	13.2	12.6	5.8	9.1	10.3	12.8
20	5.52		8.4	13.9	13.3	6.0	9.42	10.6	13.25
21	4.74		14.2	18.9	18.0	6.7	10.52	11.9	14.8
22	5.51		9.9	15.4	14.7	5.4	8.5	9.5	11.9
23	5.52		7.5	13.0	12.4	4.8	7.5	8.5	10.6
24	5.20		32.3	37.5	35.8	7.4	11.6	13.1	16.4
25	5.15		51.6	56.7	54.2	8.5	13.4	15.0	18.9
26	4.63		38.1	42.7	40.8	6.9	10.84	12.2	15.25
27	1.06	2.5	25.1	28.7	27.7	5.4	8.5	9.5	11.9
28		3.0	17.4	20.4	19.5	4.4	6.9	7.8	9.7
29		3.2	13.6	16.8	16.1	4.2	6.6	7.42	9.30
30		3.2	10.4	13.6	13.0	4.1	6.4	7.24	9.10
31		3.2	9.2	12.4	11.8	3.88	6.00	6.86	8.58
Total	103.75	33.1	497.2	633.9	605.8	326.5	511.75	577.6	721.8
Average			16.1	20.4	19.5	10.5	16.5	18.6	23.2
Maximum			51.6	56.7	54.2	31.0	48.7	54.8	68.5
Minimum			6.0	9.5	9.1	3.88	6.00	6.86	8.58

QUANTITIES IN MILLION GALLONS PER DAY

Sept.	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping	By Gravity							
1926	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.2	8.0	11.2	10.7	4.4	6.9	7.8	9.7
2		3.2	6.7	9.9	9.45	3.9	6.06	6.83	8.55
3		3.2	6.0	9.2	8.8	3.5	5.5	6.19	7.7
4	3.16	1.4	5.8	10.4	9.95	6.3	9.9	11.15	13.9
5		3.3	5.0	8.2	7.8	7.4	11.6	13.1	16.4
6		3.3	16.8	20.1	19.2	8.0	12.56	14.1	17.7
7		3.3	11.3	14.6	13.8	7.4	11.6	13.1	16.4
8		3.3	32.9	36.2	34.6	9.0	14.1	15.9	19.9
9		3.3	20.6	23.9	22.8	13.6	21.3	24.1	30.1
10		3.3	26.4	29.7	28.4	7.8	12.3	13.8	17.2
11		3.3	62.0	65.2	62.3	8.7	13.66	15.4	19.3
12		3.3	33.5	36.8	35.2	6.3	9.9	11.15	13.9
13		3.3	23.2	26.5	25.3	5.2	8.15	9.2	11.5
14		3.3	17.4	20.7	19.8	5.4	8.5	9.5	11.9
15		3.3	14.8	18.1	17.3	5.4	8.5	9.5	11.9
16		3.75	12.9	16.7	15.9	5.4	8.5	9.5	11.9
17		3.75	10.4	14.2	13.6	4.8	7.5	8.5	10.6
18		3.7	9.4	13.1	12.5	4.6	7.2	8.1	10.2
19		3.65	8.9	12.6	12.0	4.6	7.2	8.1	10.2
20	1.88	3.12	7.7	12.7	12.1	4.4	6.9	7.8	9.7
21	4.94	None	5.8	10.7	10.2	4.4	6.9	7.8	9.7
22	3.67	None	20.0	23.7	22.7	5.2	8.15	9.2	11.5
23	3.19	1.57	34.8	39.6	37.8	6.9	10.84	12.2	15.25
24		3.7	21.3	25.0	23.9	4.1	6.4	7.24	9.10
25		3.6	18.1	21.7	20.7	4.2	6.6	7.42	9.30
26		3.6	16.1	19.7	18.7	7.4	11.6	13.1	16.40
27		3.6	14.9	18.5	17.7	8.7	13.66	15.4	19.30
28		3.6	14.2	17.8	17.0	5.6	8.8	9.9	12.40
29		3.6	14.2	17.8	17.0	4.2	6.6	7.42	9.30
30	1.80	2.32	11.9	16.0	15.3	3.7	5.8	6.55	8.20
Total	18.64	90.9	511.0	620.5	592.5	180.5	283.2	319.0	399.1
Average			17.0	20.7	19.8	6.0	9.4	10.6	13.3
Maximum			62.0	65.2	62.3	13.55	21.3	24.1	30.1
Minimum			5.0	8.2	7.7	3.5	5.5	6.19	7.7

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)±57.1%	Total Runoff at Cantrell Creek Intake (6)±76.9%	Total Runoff at Bradley Creek Intake (6)±121.1%
	By Pumping	By Gravity							
Oct.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.3	12.6	15.9	15.2	9.0	14.1	15.9	19.9
2		3.6	16.8	20.4	19.5	14.2	22.3	25.2	31.4
3		3.6	18.7	22.3	21.3	8.5	13.4	15.0	18.9
4		3.5	14.2	17.7	16.9	5.8	9.1	10.3	12.8
5	2.09	1.67	12.6	16.4	15.7	5.6	8.8	9.9	12.4
6		3.6	12.9	16.5	15.8	4.6	7.2	8.1	10.2
7		3.6	11.0	14.6	13.95	4.2	6.6	7.42	9.3
8		3.5	9.2	12.7	12.1	4.2	6.6	7.42	9.3
9		3.6	7.7	11.3	10.8	4.2	6.6	7.42	9.3
10		3.5	7.4	10.9	10.4	4.4	6.9	7.8	9.7
11	2.42	1.1	7.5	11.0	10.5	4.6	7.2	8.1	10.2
12	1.84	None	8.2	10.0	9.5	4.8	7.5	8.5	10.6
13	5.04	None	14.8	19.8	18.9	11.3	17.75	19.9	25.0
14	4.53	None	18.1	22.6	21.6	6.5	10.2	11.5	14.4
15		3.5	12.9	16.4	15.7	3.9	6.09	6.87	8.60
16		3.5	11.6	15.1	14.4	6.0	9.42	10.6	13.25
17		3.5	10.2	13.7	13.1	6.5	10.2	11.5	14.4
18		3.4	8.9	12.3	11.7	4.8	7.5	8.5	10.6
19		3.4	7.5	10.9	10.4	4.6	7.2	8.1	10.2
20	1.57	2.5	6.9	11.0	10.5	4.2	6.6	7.42	9.3
21	.72	2.9	6.1	9.7	9.3	4.1	6.4	7.24	9.10
22		3.5	6.0	9.5	9.1	3.9	6.09	6.87	8.60
23		3.6	5.8	9.4	9.0	3.7	5.80	6.5	8.2
24		3.6	7.5	11.1	10.6	7.6	11.9	13.4	16.8
25		3.6	12.6	16.2	15.5	6.9	10.84	12.2	15.25
26		3.6	9.9	13.5	12.9	6.0	9.42	10.6	13.25
27		3.7	8.7	12.4	11.8	5.4	8.5	9.5	11.9
28	1.81	2.2	7.7	11.7	11.2	4.8	7.5	8.5	10.6
29		3.7	7.4	11.1	10.6	4.4	6.9	7.8	9.7
30		3.6	7.7	11.3	10.8	5.2	8.15	9.2	11.5
31		3.6	7.7	11.3	10.8	4.8	7.5	8.5	10.6
Total	20.02	91.97	316.8	428.7	409.55	178.7	280.26	315.76	395.25
Average			10.2	13.8	13.2	5.76	9.04	10.2	12.7
Maximum			18.7	22.6	21.6	14.2	22.3	25.2	31.4
Minimum			5.8	9.4	9.0	3.68	5.80	6.5	8.2

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)±57.1%	Total Runoff at Cantrell Creek Intake (6)±76.9%	Total Runoff at Bradley Creek Intake (6)±121.1%
	By Pumping	By Gravity							
Nov.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.6	8.9	12.5	11.9	4.6	7.2	8.1	10.2
2	1.85	2.2	8.0	12.0	11.5	4.2	6.6	7.42	9.3
3		3.6	7.5	11.1	10.6	4.2	6.6	7.42	9.3
4	2.00	2.2	7.2	11.4	10.9	4.1	6.4	7.24	9.10
5	2.93	1.7	6.1	10.7	10.2	4.1	6.4	7.24	9.10
6	3.02	1.7	5.8	10.5	10.0	4.1	6.4	7.24	9.10
7		3.5	5.5	9.0	8.6	4.1	6.4	7.24	9.10
8	2.98	1.7	5.7	10.4	9.9	4.2	6.6	7.42	9.3
9	.68	3.1	30.9	34.7	32.7	27.1	42.5	47.9	59.9
10		3.5	29.7	33.2	31.7	12.8	20.0	22.6	28.3
11		3.6	20.6	24.2	23.1	10.0	15.7	17.6	22.1
12		3.6	16.8	20.4	19.5	8.5	13.4	15.0	18.9
13		3.5	14.8	18.3	17.5	7.8	12.3	13.8	17.2
14		3.5	14.8	18.3	17.5	9.4	14.7	16.6	20.8
15		3.0	671.	674.0	543.7	81.3	127.8	143.9	179.8
16		3.5	271.	274.5	262.2	67.2	105.5	118.9	148.5
16		3.5	85.2	88.7	84.7	32.3	50.7	57.1	71.3
18		3.5	70.3	73.8	70.5	60.1	94.4	106.2	132.9
19		3.5	53.5	57.0	54.5	34.2	53.7	60.4	75.6
20		3.5	41.9	45.4	43.4	25.2	39.6	44.6	55.7
21		3.5	38.1	41.6	39.7	20.7	32.5	36.7	45.8
22		3.5	31.6	35.1	33.5	18.2	28.6	32.2	40.2
23		3.5	29.1	32.6	31.2	16.3	25.6	28.8	36.1
24		3.5	25.8	29.3	28.0	14.9	23.4	26.3	32.9
25		3.5	24.5	28.0	26.8	14.2	22.3	25.2	31.4
26		3.5	43.8	47.3	45.2	37.2	58.4	65.8	82.2
27		3.5	49.0	52.5	50.2	29.1	45.7	51.5	64.3
28		3.5	36.8	40.3	38.5	22.6	35.5	40.0	50.0
29		3.5	32.3	35.8	34.2	19.4	30.5	34.3	42.9
30		3.5	32.3	35.8	34.2	18.1	28.4	32.0	40.0
Total	13.46	96.50	1718.5	1828.4	1646.1	620.2	973.8	1096.7	1371.3
Average			57.36	60.9	54.8	20.7	32.5	36.6	45.8
Maximum			671.0	674.0	543.7	81.3	127.8	143.9	179.8
Minimum			5.5	9.0	8.6	4.07	6.4	7.24	9.10

QUANTITIES IN MILLION GALLONS PER DAY

1926	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping	By Gravity							
Dec.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	29.0	32.5	31.0	16.8	26.4	29.7	37.2
2		3.5	26.4	29.9	28.6	16.1	25.2	28.5	35.6
3		3.6	24.5	28.1	26.8	15.5	24.3	27.4	34.2
4		3.7	21.9	25.6	24.5	14.2	22.3	25.2	31.4
5		3.7	20.0	23.7	22.6	13.6	21.3	24.0	30.1
6		3.7	18.7	22.4	21.4	12.9	20.2	22.8	28.5
7		3.7	16.8	20.5	19.6	12.3	19.3	21.8	27.2
8		3.65	15.4	19.2	18.3	12.3	19.3	21.8	27.2
9		3.7	23.2	26.9	25.9	12.3	19.3	21.8	27.2
10		3.7	29.0	32.7	31.2	11.9	18.7	21.05	26.3
11		3.65	24.5	28.2	26.9	11.6	18.2	20.5	25.6
12		3.7	25.8	29.5	28.2	12.6	19.8	22.3	27.9
13		3.65	47.7	51.4	49.1	19.4	30.5	34.3	42.9
14		3.65	41.9	45.6	43.5	14.2	22.3	25.2	31.4
15		3.6	41.9	45.5	43.4	15.5	24.3	27.4	34.2
16		3.7	38.7	42.4	40.5	14.2	22.3	25.2	31.4
17		3.65	34.2	37.9	36.2	12.9	20.2	22.8	28.5
18		3.6	31.0	34.6	33.0	12.3	19.3	21.8	27.2
19		3.6	28.4	32.0	30.6	11.9	18.7	21.05	26.3
20		3.4	25.8	29.2	27.9	11.9	18.7	21.05	26.3
21		3.45	25.1	28.6	27.3	12.3	19.3	21.8	27.2
22		3.5	36.8	40.3	38.5	14.2	22.3	25.2	31.4
23		3.5	31.0	34.5	32.9	11.9	18.7	21.05	26.3
24		3.4	41.9	45.3	43.3	14.2	22.3	25.2	31.4
25		3.1	219.	222.1	212.1	69.7	109.5	123.2	153.9
26		3.2	187.	190.2	181.6	71.0	111.5	125.5	157.0
27		3.4	97.5	100.9	96.4	35.5	55.7	62.7	78.5
28		3.6	208.	211.6	202.1	85.2	133.7	150.7	188.2
29		3.65	144.	147.7	141.1	59.5	93.5	105.3	131.5
30		3.6	99.4	103.0	98.4	41.4	64.9	73.2	91.6
31		3.7	77.4	81.1	77.5	33.6	52.8	59.5	74.2
Total		110.75	1731.9	1843.1	1760.4	722.9	1134.8	1279.0	1597.8
Average			55.3	58.9	56.25	23.1	36.2	40.8	51.0
Maximum			219.	222.1	212.1	85.2	133.7	150.7	188.2
Minimum			15.4	19.2	18.3	11.6	18.2	20.5	25.6

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
Jan.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.65	63.9	67.6	64.6	29.1	45.7	51.4	64.4
2		3.50	53.6	57.1	54.6	25.8	40.5	45.6	57.1
3		3.70	46.4	50.1	47.8	23.3	36.6	41.2	51.6
4		3.60	41.9	45.5	43.5	22.0	34.5	38.9	48.6
5		3.65	38.1	41.8	39.9	20.0	31.4	35.3	44.3
6		3.60	34.8	38.4	36.7	18.9	29.7	33.4	41.8
7		3.60	31.6	35.2	34.6	18.1	28.4	32.0	40.0
8		3.65	29.0	32.7	31.2	17.5	27.4	30.9	38.7
9		3.70	27.1	30.8	29.4	16.8	26.4	29.7	37.2
10	1.22	3.65	25.1	30.0	28.6	16.2	25.4	28.6	35.8
11	2.54	3.60	20.6	26.7	25.5	16.2	25.4	28.6	35.8
12	2.79	3.00	20.0	25.8	24.6	16.2	25.4	28.6	35.8
13	1.78	3.60	18.7	24.1	23.0	15.5	24.3	27.4	34.2
14		3.60	29.0	32.6	31.1	16.2	25.4	28.6	35.8
15	1.49	3.55	23.2	28.2	26.9	16.2	25.4	28.6	35.8
16	3.19	2.60	23.2	29.0	27.7	16.8	26.4	29.7	37.2
17		3.60	20.6	24.2	23.1	16.8	26.4	29.7	37.2
18		3.60	19.3	22.9	21.9	16.8	26.4	29.7	37.2
19		3.70	18.7	22.4	21.4	16.8	26.4	29.7	37.2
20		3.65	21.9	25.6	24.4	16.2	25.4	28.6	35.8
21		3.70	28.4	32.1	30.7	14.9	23.4	26.3	32.9
22		3.60	25.8	29.4	28.1	14.2	22.3	25.2	31.4
23		3.70	24.5	28.2	26.9	14.2	22.3	25.2	31.4
24		3.60	25.1	28.7	27.4	13.6	21.3	24.0	30.1
25		3.60	26.5	30.1	28.7	13.6	21.3	24.0	30.1
26	3.81		27.1	30.9	29.5	15.5	24.3	27.4	34.2
27	5.70		25.1	30.8	29.4	15.5	24.3	27.4	34.2
28	4.75		23.9	28.7	27.4	16.2	25.4	28.6	35.8
29	4.85		29.7	34.6	33.0	18.9	29.7	33.4	41.8
30	1.39		31.0	32.4	30.9	16.8	26.4	29.7	37.2
31	3.51		31.0	34.5	33.0	16.2	25.4	28.6	35.8
Total	37.02	89.0	904.8	1031.1	985.5	541.0	849.0	956.	1196.4
Average			29.2	33.2	31.8	17.4	27.4	30.8	38.5
Maximum			63.9	67.6	64.6	29.1	45.7	51.4	64.4
Minimum			18.7	22.4	21.4	13.55	21.3	24.0	30.1

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
Feb.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	5.47		25.1	30.6	29.2	15.5	24.3	27.4	34.3
2	5.54		24.5	30.0	28.6	14.9	23.4	26.3	32.9
3	5.53		24.5	30.0	28.6	14.2	22.3	25.2	31.4
4	5.54		28.4	33.9	32.4	14.2	22.3	25.2	31.4
5	4.13		27.1	31.2	29.8	13.6	21.3	24.0	30.1
6	2.38	1.90	31.0	35.3	33.7	12.9	20.2	22.8	28.5
7	3.87	1.90	36.1	41.9	40.0	12.9	20.2	22.8	28.5
8	3.96	1.90	31.0	36.9	35.2	12.9	20.2	22.8	28.5
9	4.18		27.1	31.3	29.9	13.6	21.3	24.0	30.1
10	3.57	1.90	25.1	30.6	29.2	12.9	20.2	22.8	28.5
11	3.35	1.90	23.9	29.2	27.9	12.6	19.8	22.3	27.9
12	2.83	1.90	21.9	26.6	25.4	12.9	20.2	22.8	28.5
13	0.77	2.00	43.9	46.7	44.6	25.2	39.6	44.5	55.7
14	2.84	1.90	63.9	68.6	65.6	20.0	31.4	35.4	44.25
15	2.73	1.90	45.2	49.8	47.6	18.1	28.4	32.0	40.0
16	2.73	1.90	38.1	42.7	40.8	16.2	25.4	28.6	35.8
17	2.76	1.90	34.8	39.5	37.7	15.5	24.3	27.4	34.3
18	2.85	2.00	32.3	37.2	35.5	14.2	22.3	25.2	31.4
19	2.64	2.00	41.3	45.9	43.8	20.0	31.4	35.4	44.25
20		3.96	65.2	69.2	66.1	16.8	26.4	29.7	37.2
21	2.65	1.95	47.7	52.3	50.0	16.8	26.4	29.7	37.2
22	2.74	1.90	41.9	46.5	44.4	16.2	25.4	28.6	35.8
23	2.75	1.98	137.0	141.7	135.3	38.8	60.9	68.6	85.8
24	2.81	2.00	109.5	114.3	109.3	29.7	46.6	52.5	65.7
25	2.89	1.98	75.5	80.4	76.8	25.2	39.6	44.5	55.7
26	2.85	2.00	61.9	66.8	63.8	22.0	34.5	38.9	48.6
27			51.6	51.6	49.3	19.4	30.46	34.3	42.9
28	3.32	1.95	43.9	49.2	47.0	17.5	27.4	30.9	38.7
Total	87.68	42.72	1259.4	1389.9	1327.5	494.7	776.2	874.6	1093.9
Average			45.0	49.6	47.4	17.7	27.7	31.2	39.1
Maximum			137.0	141.7	135.3	38.8	60.9	68.6	85.8
Minimum			21.9	26.6	25.4	12.6	19.8	22.3	27.9

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping	By Gravity							
March	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	2.65	1.95	42.0	46.6	44.5	16.8	26.4	29.7	37.2
2	2.80	1.95	38.1	42.9	41.0	16.8	26.4	29.7	37.2
3	2.75	1.95	32.9	37.6	35.9	14.9	23.4	26.3	32.9
4	2.91	1.95	32.3	37.2	35.5	14.8	23.2	26.2	32.7
5	2.63	1.90	32.3	36.8	35.2	16.2	25.4	28.6	35.8
6		1.95	36.8	38.8	37.1	18.7	29.4	33.1	41.3
7	4.27	2.00	38.7	45.0	43.0	20.7	32.5	36.7	45.8
8	3.59		93.5	97.1	92.7	38.1	59.8	67.4	84.2
9		3.50	109.5	113.0	108.0	45.9	72.1	81.1	101.5
10		3.50	105.8	109.3	104.4	41.4	65.0	73.2	91.6
11		3.20	85.2	88.4	84.3	34.3	53.9	60.7	75.8
12		2.20	72.3	75.5	72.1	30.4	47.7	53.8	67.2
13		3.20	85.2	88.4	84.3	54.4	85.5	96.2	120.4
14		3.15	112.2	115.4	110.2	63.4	99.6	112.2	140.1
15		3.15	79.4	82.6	78.9	45.3	71.1	80.1	100.2
16		3.15	63.9	67.1	64.0	36.2	56.8	64.0	80.0
17		3.50	54.8	58.3	55.7	30.4	47.7	53.8	67.2
18		3.50	47.7	51.2	48.9	27.2	42.7	48.1	59.8
19		3.50	43.2	46.7	44.6	24.6	38.7	43.5	54.5
20		3.50	40.0	43.5	41.6	22.6	35.5	40.0	50.0
21		3.50	38.1	41.6	39.7	23.3	36.6	41.2	51.5
22		3.50	38.1	41.6	39.7	23.3	36.6	41.2	51.6
23		3.50	34.8	38.3	36.6	20.0	31.4	35.4	44.25
24		3.50	32.9	36.4	34.8	20.7	32.5	36.7	45.8
25		3.50	31.6	35.1	33.5	22.0	34.5	38.9	48.6
26		3.50	31.0	34.5	32.9	22.0	34.5	38.9	48.6
27		3.50	29.7	33.2	31.7	20.7	32.5	36.7	45.8
28		3.50	28.4	31.9	30.4	20.0	31.4	35.4	44.25
29		3.50	26.5	30.0	28.7	18.7	29.4	33.1	41.3
30	.58		25.8	26.4	25.2	18.1	28.4	32.0	40.0
31	2.49		25.1	27.6	26.4	18.1	28.4	32.0	40.0
Total	24.67	84.20	1587.8	1698.0	1621.5	840.0	1319.0	1485.9	1857.1
Average			51.2	54.7	52.3	27.1	44.8	47.9	59.80
Maximum			112.2	115.4	110.2	63.4	99.6	112.2	140.1
Minimum			25.1	26.4	25.2	14.85	23.2	26.2	32.7

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
April	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	3.11		25.1	28.2	26.9	17.4	27.4	30.8	38.5
2	3.34	3.90	23.9	31.1	29.7	16.1	25.2	28.5	35.6
3		3.50	21.9	25.4	24.2	15.5	24.3	27.4	34.2
4		3.55	20.6	24.2	23.1	15.5	24.3	27.4	34.2
5	1.01		21.9	22.9	21.8	15.5	24.3	27.4	34.2
6		3.50	23.9	27.4	26.2	14.9	23.4	26.3	32.9
7		3.50	20.6	24.1	23.0	14.2	22.3	25.2	31.4
8		3.50	20.6	24.1	23.0	14.2	22.3	25.2	31.4
9		3.50	25.1	28.6	27.4	18.1	28.4	32.0	40.0
10		3.55	69.0	72.6	69.4	15.5	24.3	27.4	34.2
11		3.50	51.6	55.1	52.6	14.2	22.3	25.2	31.4
12		3.50	41.9	45.4	43.3	14.2	22.3	25.2	31.4
13		3.50	36.1	39.6	37.8	14.2	22.3	25.2	31.4
14		3.50	32.9	36.4	34.8	13.6	21.3	24.0	30.1
15		3.50	30.9	34.4	32.9	12.9	20.2	22.8	28.5
16		3.50	29.0	32.5	31.0	14.2	22.3	25.2	31.4
17		3.55	28.4	32.0	30.6	12.9	20.2	22.8	28.5
18		3.50	25.8	29.3	28.0	12.6	19.8	22.3	27.9
19		3.50	25.1	28.6	27.4	14.2	22.3	25.2	31.4
20		3.50	24.5	28.0	26.8	12.6	19.8	22.3	27.9
21		3.50	29.7	33.2	31.7	15.5	24.3	27.4	34.2
22		3.50	67.0	70.5	67.4	20.7	32.5	36.7	45.8
23		3.50	46.4	49.9	47.6	14.9	23.4	26.3	32.9
24		3.50	40.0	43.5	41.5	14.2	22.3	25.2	31.4
25		3.50	36.1	39.6	37.8	14.2	22.3	25.2	31.4
26		3.50	32.9	36.4	34.8	13.6	21.3	24.0	30.1
27		3.50	31.6	35.1	33.5	12.9	20.2	22.8	28.5
28		3.50	29.7	33.2	31.7	12.3	19.3	21.8	27.2
29		3.50	29.7	33.2	31.7	11.9	18.7	21.05	26.3
30		3.60	32.3	35.9	34.3	13.6	21.3	24.0	30.1
Total	7.46	98.65	974.2	1080.4	1031.9	436.3	684.6	772.2	964.4
Average			32.5	36.0	34.4	14.5	22.8	25.7	32.1
Maximum			69.0	72.6	69.4	20.7	32.5	36.7	45.8
Minimum			20.6	22.9	21.8	11.9	18.7	21.05	26.3

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
May	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.60	30.9	34.5	32.9	12.6	19.8	22.3	27.9
2		3.60	27.1	20.7	19.7	11.6	18.2	20.5	25.6
3		3.40	26.4	29.8	28.4	11.6	18.2	20.5	25.6
4		3.20	20.0	23.2	22.2	11.3	17.75	20.0	25.0
5		3.20	18.1	21.3	20.3	10.3	16.16	18.22	22.8
6		3.20	14.8	18.0	17.2	10.6	16.65	18.75	23.4
7		3.40	14.2	17.6	16.8	10.3	16.16	18.22	22.8
8		3.38	13.6	17.0	16.2	10.3	16.16	18.22	22.8
9		3.40	11.9	15.3	14.6	10.3	16.16	18.22	22.8
10		3.40	10.4	13.8	13.2	10.0	15.7	17.7	22.1
11		3.40	9.7	13.1	12.5	9.4	14.7	16.6	20.8
12		3.30	7.9	11.2	10.7	9.2	14.45	16.28	20.3
13		3.30	7.4	10.7	10.2	9.0	14.14	15.92	19.9
14		3.30	7.1	10.4	9.9	9.2	14.45	16.28	20.3
15		3.30	6.4	9.7	9.3	9.0	14.14	15.92	19.9
16		3.30	5.9	9.2	8.8	9.2	14.45	16.28	20.3
17		3.20	5.3	8.5	8.1	9.2	14.45	16.28	20.3
18		3.20	4.4	7.6	7.2	8.7	13.65	15.4	19.2
19		3.30	3.9	7.2	6.9	8.3	13.05	14.7	18.4
20		3.20	3.4	6.6	6.3	8.3	13.05	14.7	18.4
21		3.30	3.5	6.8	6.5	8.0	12.56	14.15	17.7
22		3.30	2.7	6.0	5.7	7.6	11.9	13.4	16.8
23		3.20	2.3	5.5	5.2	7.8	12.25	13.8	17.25
24		3.30	2.0	5.3	5.1	8.5	13.4	15.0	18.9
25	0.28	3.20	2.1	5.6	5.3	8.3	13.05	14.7	18.4
26		3.20	1.9	5.1	4.9	7.4	11.6	13.1	16.4
27		3.20	1.2	4.4	4.2	7.1	11.15	12.56	15.7
28		3.60	1.7	5.3	5.1	9.7	15.2	17.2	21.4
29		3.60	32.9	36.5	34.9	20.7	32.5	36.7	45.8
30		3.60	30.0	33.6	32.1	14.9	23.4	26.3	32.9
31		3.50	51.6	55.1	52.6	14.2	22.3	25.2	31.4
Total		103.58	380.7	474.6	453.0	312.6	490.8	553.1	691.2
Average			12.3	15.3	14.6	10.1	15.85	17.85	22.35
Maximum			51.6	55.1	52.6	20.7	32.5	36.7	45.8
Minimum			1.2	4.4	4.2	7.1	11.15	12.56	15.7

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
June	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	50.3	53.8	51.3	14.2	22.3	25.2	31.4
2		3.5	27.1	30.6	29.2	12.9	20.2	22.8	28.5
3		3.6	23.2	26.8	25.6	12.9	20.2	22.8	28.5
4		3.5	17.4	20.9	19.9	11.6	18.2	20.5	25.6
5		3.6	11.5	15.1	14.4	10.6	16.65	18.75	23.4
6		3.6	8.5	12.1	11.6	10.3	16.16	18.22	22.8
7		3.6	21.9	25.5	24.3	12.9	20.10	22.8	28.6
8		3.6	15.5	19.1	18.2	11.3	17.75	20.0	25.0
9		3.6	21.9	25.5	24.3	10.6	16.65	18.75	23.4
10		3.5	20.0	23.5	22.4	10.0	15.7	17.7	22.1
11		3.5	16.1	19.6	18.7	10.3	16.16	18.22	22.8
12		3.5	30.3	33.8	32.3	14.2	22.3	25.2	31.4
13		3.5	30.9	34.4	32.8	10.3	16.16	18.22	22.8
14			43.2	43.2	41.2	10.0	15.7	17.7	22.1
15			67.1	67.1	64.1	12.3	19.3	21.8	27.2
16			58.7	58.7	56.1	12.3	19.3	21.8	27.2
17			41.3	41.3	39.4	12.3	19.3	21.8	27.2
18			70.3	70.3	67.1	22.6	35.5	40.0	50.1
19			67.1	67.1	64.1	12.9	20.2	22.8	28.5
20			46.4	46.4	44.3	10.3	16.16	18.22	22.8
21		3.5	38.1	41.6	39.8	10.3	16.16	18.22	22.8
22		3.5	32.9	36.4	34.8	11.0	17.2	19.4	24.3
23		3.5	29.0	32.5	31.1	9.0	14.14	15.92	19.9
24		3.5	25.1	28.6	27.3	10.3	16.16	18.22	22.8
25		3.5	23.2	26.7	25.5	10.0	15.7	17.7	22.1
26		3.5	19.3	22.8	21.8	9.7	15.2	17.2	21.4
27		3.5	16.1	19.6	18.7	7.8	12.25	13.8	17.25
28		3.5	13.5	17.0	16.2	7.8	12.25	13.8	17.25
29		3.5	11.9	15.4	14.6	6.5	10.2	11.5	14.4
30		3.5	10.0	13.5	12.9	6.0	9.42	10.6	13.25
Total		81.1	907.8	988.9	944.1	333.2	522.7	589.6	736.8
Average			30.2	33.0	31.4	11.1	17.4	19.6	24.6
Maximum			70.3	70.3	67.1	22.6	35.5	40.0	50.1
Minimum			8.5	12.1	11.6	6.0	9.42	10.6	13.25

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
July	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	9.2	12.7	12.1	5.4	8.5	9.5	11.9
2		3.6	9.2	12.8	12.2	6.6	10.35	11.7	14.6
3		3.6	7.9	11.5	11.0	5.0	7.85	8.85	11.05
4		3.5	7.4	10.9	10.4	7.5	11.77	13.3	16.6
5		3.6	6.8	10.4	10.0	9.2	14.45	16.28	20.3
6		3.6	6.8	10.4	10.0	5.4	8.58	9.55	11.9
7		3.6	6.8	10.4	10.0	5.2	8.15	9.2	11.5
8		3.6	9.2	12.8	12.2	8.4	13.2	14.8	18.6
9		3.5	7.7	11.2	10.7	14.2	22.3	25.1	31.4
10		3.6	7.7	11.3	10.8	9.7	15.2	17.2	21.4
11		3.5	8.1	11.6	11.1	11.0	17.2	19.4	24.3
12		3.5	12.5	16.0	15.3	9.0	14.1	15.9	19.9
13		3.5	16.2	19.7	18.8	8.5	13.4	15.0	18.9
14		3.5	9.2	12.7	12.1	6.3	9.9	11.15	13.9
15		3.5	8.1	11.6	11.1	5.4	8.5	9.5	11.9
16		3.5	9.2	12.7	12.1	14.8	23.2	26.2	32.7
17		3.5	8.1	11.6	11.1	12.6	19.8	22.3	27.9
18		3.5	18.1	21.6	20.6	8.4	13.2	14.85	18.6
19		3.5	14.2	17.7	16.9	7.8	12.3	13.8	17.2
20		3.5	8.5	12.0	11.5	18.1	28.4	32.0	40.0
21		3.5	7.7	11.2	10.7	15.1	23.7	26.7	33.4
22		3.5	7.7	11.2	10.7	10.6	16.7	18.8	23.4
23		3.5	7.2	10.7	10.2	9.0	14.14	15.92	19.9
24		3.5	6.1	9.6	9.2	9.0	14.14	15.92	19.9
25		3.5	5.5	9.0	8.6	9.2	14.45	16.28	20.3
26		3.5	6.5	10.0	9.6	11.0	17.3	19.5	24.3
27		3.5	6.3	9.8	9.4	10.1	15.85	17.85	22.3
28		3.5	4.9	8.4	8.0	8.7	13.65	15.4	19.2
29		3.5	4.3	7.8	7.4	8.5	13.4	15.0	18.9
30		3.5	4.1	7.6	7.2	6.2	9.74	10.96	13.7
31		3.5	5.0	8.5	8.1	7.1	11.15	12.56	15.7
Total		109.2	256.2	365.4	349.1	283.0	444.6	500.5	625.6
Average			8.3	11.8	11.3	9.2	14.35	16.15	20.2
Maximum			18.1	21.6	20.6	18.1	28.4	32.0	40.0
Minimum			4.1	7.6	7.2	5.0	7.85	8.85	11.05

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping	By Gravity							
Aug.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	5.4	8.9	8.5	9.0	14.14	15.92	19.9
2		3.5	4.4	7.9	7.5	7.3	11.4	12.9	16.1
3		3.5	3.8	7.3	7.0	7.3	11.4	12.9	16.1
4		3.5	4.1	7.6	7.3	7.5	11.77	13.3	16.6
5		3.5	3.82	7.3	7.0	6.6	10.35	11.7	14.6
6		3.5	3.71	7.2	6.9	5.6	8.8	9.9	12.4
7		3.5	3.26	6.8	6.5	5.8	9.1	10.3	12.8
8		3.5	8.77	12.3	11.7	6.9	10.84	12.2	15.25
9		3.5	5.4	8.9	8.5	6.0	9.42	10.6	13.25
10		3.5	4.39	7.9	7.5	10.0	15.70	17.7	22.1
11		3.5	8.06	11.6	11.1	30.3	47.6	53.7	66.9
12		3.5	9.22	12.7	12.1	30.3	47.6	53.7	66.9
13		3.5	6.77	10.3	9.8	16.7	26.2	29.5	36.9
14		3.5	5.59	9.1	8.7	14.8	23.2	26.2	32.7
15		3.5	4.96	8.5	8.1	14.2	22.3	25.1	31.4
16		3.5	4.62	8.1	7.7	15.5	24.3	27.4	34.2
17		3.5	4.96	8.5	8.1	42.6	67.0	75.4	94.4
18		3.5	4.96	8.5	8.1	31.6	49.7	56.0	70.0
19		3.5	4.60	8.1	7.7	18.1	28.4	32.0	40.0
20		3.5	4.16	7.7	7.3	14.2	22.3	25.1	31.4
21		3.5	3.84	7.3	7.0	10.9	17.1	19.3	24.1
22		3.5	3.48	7.0	6.7	8.4	13.2	14.85	18.6
23		3.5	3.26	6.8	6.5	7.1	11.15	12.56	15.7
24		3.5	3.03	6.5	6.2	6.6	10.35	11.7	14.6
25		3.5	2.84	6.3	6.0	6.6	10.35	11.7	14.6
26		3.5	2.84	6.3	6.0	9.2	14.5	16.2	20.2
27		3.5	5.87	9.4	9.0	12.9	20.2	22.8	28.5
28		3.5	9.22	12.7	12.1	8.7	13.65	15.4	19.2
29		3.5	6.13	9.6	9.2	7.5	11.77	13.3	16.6
30		3.5	5.09	8.6	8.2	12.7	19.95	22.4	28.1
31		3.5	5.61	9.1	8.7	11.6	18.2	20.5	25.6
Total		108.5	156.2	264.8	252.7	402.5	631.9	712.2	889.7
Average			5.04	8.5	8.1	13.0	20.4	23.0	28.7
Maximum			9.22	12.7	12.1	42.6	67.0	75.4	94.4
Minimum			2.84	6.3	6.0	5.6	8.8	9.9	12.4

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) ± 57.1%	Total Runoff at Cantrell Creek Intake (6) ± 76.9%	Total Runoff at Bradley Creek Intake (6) ± 121.1%
	By Pumping	By Gravity							
Sept.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	4.96	8.5	8.1	8.4	13.2	14.85	18.6
2		3.5	4.16	7.7	7.4	7.5	11.77	13.3	16.6
3		3.5	3.71	7.2	6.9	7.1	11.15	12.56	15.7
4		3.5	3.26	6.8	6.5	6.9	10.84	12.2	15.25
5		3.5	3.16	6.7	6.4	6.2	9.74	10.96	13.7
6		3.5	3.48	7.0	6.7	6.2	9.74	10.96	13.7
7		3.5	3.26	6.8	6.5	5.6	8.8	9.9	12.4
8		3.5	6.12	9.6	9.2	5.2	8.15	9.2	11.5
9		3.5	4.96	8.5	8.1	8.0	12.56	14.15	17.7
10		3.5	4.06	7.6	7.3	8.0	12.56	14.15	17.7
11		3.4	3.48	6.9	6.6	6.6	10.35	11.7	14.6
12		3.3	3.16	6.5	6.2	5.8	9.1	10.3	12.8
13		3.3	2.93	6.2	5.9	5.4	8.5	9.5	11.9
14		3.3	2.71	6.0	5.7	5.0	7.85	8.85	11.05
15		3.2	2.51	5.7	5.4	4.8	7.5	8.5	10.6
16		3.15	2.42	5.6	5.3	4.6	7.2	8.1	10.2
17		3.1	2.19	5.3	5.1	4.4	6.9	7.8	9.7
18		3.0	4.32	7.3	7.0	4.2	6.6	7.42	9.3
19		3.2	3.26	6.5	6.2	6.1	9.6	10.8	13.5
20		3.1	2.93	6.0	5.7	5.6	8.8	9.9	12.4
21		3.1	2.51	5.6	5.3	4.8	7.5	8.5	10.6
22		2.6	2.19	4.8	4.6	4.2	6.6	7.42	9.3
23		2.0	2.19	4.2	4.0	3.9	6.09	6.87	8.6
24		2.0	2.09	4.1	3.9	3.5	5.5	6.2	7.7
25		1.9	2.00	3.9	3.7	3.5	5.5	6.2	7.7
26		1.75	2.00	3.8	3.6	3.9	6.09	6.87	8.6
27		1.7	2.00	3.7	3.5	4.9	7.7	8.6	10.8
28		1.8	1.91	3.7	3.5	3.9	6.09	6.87	8.6
29		1.8	1.91	3.7	3.5	3.7	5.8	6.5	8.2
30		1.8	1.72	3.5	3.3	3.7	5.8	6.5	8.2
Total		87.5	91.60	179.4	171.1	161.6	253.6	285.6	357.2
Average			3.05	5.98	5.70	5.39	8.45	9.52	11.91
Maximum			4.96	8.5	8.1	8.4	13.2	14.85	18.6
Minimum			1.72	3.5	3.3	3.5	5.5	6.2	7.7

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping	By Gravity							
Oct.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		1.8	1.72	3.5	3.3	3.7	5.8	6.5	8.2
2		1.8	1.64	3.4	3.2	3.9	6.09	6.87	8.6
3		1.8	1.64	3.4	3.2	4.1	6.4	7.24	9.1
4		1.85	1.72	3.6	3.4	3.7	5.8	6.5	8.2
5		1.85	1.64	3.5	3.3	3.3	5.2	5.8	7.3
6		1.85	1.58	3.4	3.2	3.3	5.2	5.8	7.3
7		1.85	1.58	3.4	3.2	3.1	4.8	5.5	6.8
8		1.85	2.07	3.9	3.7	17.4	27.4	30.8	38.5
9		3.4	2.58	6.0	5.7	8.5	13.4	15.0	18.9
10		3.5	1.58	5.1	4.9	5.4	8.58	9.55	11.9
11		3.5	1.42	4.9	4.7	8.5	13.4	15.0	18.9
12		3.5	59.4	62.9	60.1	10.6	16.65	18.75	23.4
13		3.5	27.1	30.6	29.2	20.6	32.3	36.4	45.6
14		3.5	10.2	13.7	13.1	14.2	22.3	25.1	31.4
15		3.5	7.1	10.6	10.1	11.6	18.2	20.5	25.6
16		3.5	6.0	9.5	9.1	10.3	16.16	18.22	22.8
17		3.5	5.3	8.8	8.4	9.2	14.45	16.28	20.3
18		3.5	4.64	8.1	7.7	8.0	12.56	14.15	17.7
19		3.5	4.26	7.8	7.5	7.8	12.25	13.8	17.25
20		3.5	4.06	7.6	7.3	7.3	11.4	12.9	16.1
21		3.5	3.84	7.3	7.0	6.9	10.84	12.2	15.25
22		3.5	3.84	7.3	7.0	6.6	10.35	11.7	14.6
23		3.5	3.61	7.1	6.8	6.2	9.74	10.96	13.7
24		3.5	3.39	6.9	6.6	6.0	9.42	10.6	13.25
25		3.4	3.26	6.7	6.4	6.0	9.42	10.6	13.25
26		3.3	3.16	6.5	6.2	5.8	9.1	10.3	12.8
27		3.3	3.03	6.3	6.0	5.8	9.1	10.3	12.8
28		3.2	2.94	6.1	5.9	5.6	8.8	9.9	12.4
29		3.2	2.84	6.0	5.7	5.4	8.58	9.55	11.9
30		3.2	2.61	5.8	5.5	5.4	8.58	9.55	11.9
31		3.2	2.61	5.8	5.5	5.2	8.15	9.2	11.5
Total		93.3	182.4	275.5	262.9	229.4	360.4	405.5	507.2
Average			5.87	8.9	8.5	7.4	11.6	13.1	16.4
Maximum			59.40	62.9	60.1	20.6	32.3	36.4	45.6
Minimum			1.42	3.4	3.2	3.1	4.8	5.5	6.8

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping	By Gravity							
Nov.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.1	2.61	5.7	5.4	5.1	8.0	9.0	11.3
2		3.2	2.61	5.8	5.5	6.2	9.74	10.96	13.7
3		3.5	3.16	6.7	6.4	9.2	14.45	16.28	20.3
4		3.5	3.03	6.5	6.2	6.2	9.74	10.96	13.7
5		3.5	3.03	6.5	6.2	5.6	8.8	9.9	12.4
6		3.5	3.26	6.8	6.5	5.4	8.58	9.55	11.9
7		3.5	3.39	6.9	6.6	5.1	8.0	9.0	11.3
8		3.5	3.39	6.9	6.6	5.6	8.8	9.9	12.4
9		3.5	3.39	6.9	6.6	5.6	8.8	9.9	12.4
10		3.5	3.16	6.7	6.4	5.6	8.8	9.9	12.4
11		3.5	3.03	6.5	6.2	5.6	8.8	9.9	12.4
12		3.5	3.16	6.7	6.4	5.4	8.58	9.55	11.9
13		3.5	3.26	6.8	6.5	5.4	8.58	9.55	11.9
14		3.4	3.16	6.6	6.3	5.4	8.58	9.55	11.9
15		3.4	3.26	6.7	6.4	11.3	17.75	20.0	25.0
16		3.5	31.0	34.5	32.9	12.9	20.2	22.8	28.5
17		3.5	318.0	321.5	307.0	79.5	124.9	140.6	176.0
18		3.5	66.5	70.0	66.9	27.6	43.3	48.85	61.1
19		3.5	36.8	40.3	38.5	18.7	29.4	33.1	41.4
20		3.5	25.8	29.3	27.6	16.1	25.2	28.5	35.6
21		3.5	20.0	23.5	22.5	14.2	22.3	25.2	31.4
22		3.5	16.2	19.7	18.8	12.9	20.2	22.8	28.5
23		3.5	13.6	17.1	16.3	11.9	18.7	21.05	26.3
24		3.5	11.5	15.0	14.3	11.6	18.2	20.5	25.6
25		3.5	10.4	13.9	13.3	11.3	17.75	20.0	25.0
26		3.5	9.48	13.0	12.4	10.6	16.65	18.75	23.4
27		3.5	8.52	12.0	11.5	10.3	16.16	18.22	22.8
28		3.5	7.74	11.2	10.7	10.0	15.7	17.7	22.1
29		3.5	7.61	11.1	10.6	9.7	15.2	17.2	21.4
30		3.5	7.22	10.7	10.2	10.0	15.7	17.7	22.1
Total		104.1	637.3	741.5	707.7	360.0	565.6	636.9	796.1
Average			21.2	24.7	23.6	12.0	18.8	21.2	26.5
Maximum			318.0	321.5	307.0	79.5	124.9	140.6	176.0
Minimum			2.61	5.7	5.4	5.1	8.0	9.0	11.3

QUANTITIES IN MILLION GALLONS PER DAY

1927	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
Dec.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	14.8	18.3	17.5	11.6	18.2	20.5	25.6
2		3.5	75.5	79.0	75.5	41.9	65.8	74.1	92.7
3		3.5	213.0	216.5	206.8	67.7	106.3	119.7	149.7
4		3.5	193.0	196.5	187.8	45.2	71.0	79.9	99.9
5		3.5	108.0	111.5	106.5	37.4	58.7	66.1	82.8
6		3.5	47.7	51.2	48.8	30.3	48.0	53.6	66.9
7		3.5	56.2	59.7	57.0	41.9	65.9	74.2	92.7
8		3.5	58.7	62.2	59.5	77.5	122.0	137.2	171.8
9		3.5	45.2	48.7	46.5	41.9	65.9	74.2	92.7
10		3.5	41.3	44.8	42.8	32.9	51.6	58.2	72.8
11		3.5	36.8	40.3	38.5	27.8	43.7	49.2	61.4
12		3.5	36.1	39.6	37.8	27.1	42.6	48.0	59.9
13		3.5	32.9	36.4	34.8	23.9	37.5	42.3	52.9
14		3.5	31.6	35.1	33.5	21.9	34.4	38.7	48.4
15		3.5	60.0	63.5	60.7	45.8	71.9	81.0	101.4
16		3.5	137.0	140.5	134.2	74.9	117.5	132.4	165.7
17		3.5	81.3	84.8	81.1	47.2	74.1	83.5	104.4
18		3.5	58.6	62.1	59.4	36.8	57.8	65.1	81.4
19		3.5	46.4	49.9	47.7	31.0	48.7	54.9	68.6
20		3.5	38.1	41.6	39.8	27.1	42.6	47.9	59.9
21		3.5	34.2	37.7	36.0	24.5	38.5	43.3	54.1
22		3.5	31.0	34.5	33.0	21.9	34.4	38.7	48.4
23		3.5	27.1	30.6	29.2	20.7	32.5	36.6	45.8
24		3.5	24.5	28.0	26.8	18.7	29.4	33.1	41.3
25		3.5	21.3	24.8	23.7	18.2	28.6	32.2	40.3
26		3.5	19.4	22.9	21.9	16.6	26.08	29.4	36.7
27		3.5	18.1	21.6	20.6	17.4	27.3	30.8	38.45
28		3.5	16.1	19.6	18.7	16.2	25.4	28.7	35.8
29		3.5	36.8	40.3	38.5	26.5	41.6	46.9	58.6
30		3.5	32.9	36.4	34.8	19.4	30.5	34.3	42.9
31		3.5	103.3	106.8	102.1	55.6	87.3	98.3	122.9
Total		108.5	1776.9	1885.4	1801.5	1047.5	1645.8	1853.0	2316.8
Average			57.4	60.9	58.1	33.8	53.1	59.8	74.8
Maximum			213.0	216.5	206.8	77.5	122.0	137.2	171.8
Minimum			14.8	18.3	17.5	11.6	18.2	20.5	25.6

QUANTITIES IN MILLION GALLONS PER DAY

1928	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
Jan.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	58.6	62.1	59.3	32.3	50.8	57.1	71.5
2		3.5	34.9	38.4	36.7	32.9	51.7	58.1	72.8
3		3.5	29.7	33.2	31.7	33.6	52.8	59.4	74.3
4		3.4	28.4	31.8	30.4	30.4	47.8	53.8	67.2
5		3.5	28.4	31.9	30.5	30.4	47.8	53.8	67.2
6		3.5	27.1	30.6	29.2	30.4	47.8	53.8	67.2
7		3.5	25.2	28.7	27.4	24.5	38.5	43.4	54.2
8		3.5	24.5	28.0	26.8	27.8	43.7	49.2	61.5
9		3.5	41.3	44.8	42.8	40.0	62.8	70.8	88.5
10		3.5	32.9	36.4	34.8	25.8	40.5	45.7	57.0
11		3.5	29.7	33.2	31.7	22.6	35.5	40.0	50.0
12		3.5	28.4	31.9	30.5	21.3	33.5	37.7	47.1
13		3.5	26.5	30.0	28.7	19.4	30.4	34.3	42.9
14		3.5	25.2	28.7	27.4	17.4	27.3	30.8	38.5
15		3.5	23.9	27.4	26.2	16.3	25.6	28.8	36.0
16		3.5	23.2	26.7	25.5	15.5	24.3	27.4	34.2
17		3.5	21.9	25.4	24.2	14.9	23.3	26.4	33.0
18		3.5	29.1	32.6	31.2	17.4	27.3	30.8	38.5
19		3.5	34.2	37.7	36.0	18.7	29.4	33.1	41.3
20		3.5	32.9	36.4	34.8	18.1	28.4	32.0	40.0
21		3.5	25.2	28.7	27.4	16.2	25.4	28.6	35.8
22		3.5	21.9	25.4	24.2	16.2	25.4	28.6	35.8
23		3.5	20.7	24.2	23.1	16.2	25.4	28.6	35.8
24		3.5	23.2	26.7	25.5	23.9	37.5	42.2	52.9
25		3.5	27.1	30.6	29.2	22.5	35.3	39.8	49.8
26		3.5	21.9	25.4	24.2	19.3	30.3	34.2	42.7
27		3.5	20.7	24.2	23.1	18.7	29.4	33.1	41.3
28		3.5	18.2	21.7	20.7	17.4	27.3	30.8	38.5
29		3.5	15.5	19.0	18.1	14.9	23.4	26.3	33.0
30		3.5	16.7	20.2	19.3	14.2	22.3	25.2	31.4
31		3.5	18.2	21.7	20.7	14.2	22.3	25.2	31.4
Total		108.5	835.3	943.7	901.3	683.4	1073.2	1209.0	1511.3
Average			27.0	30.4	29.0	22.0	34.6	39.0	48.7
Maximum			58.6	62.1	59.3	40.0	62.8	70.8	88.5
Minimum			15.5	19.0	18.1	14.2	22.3	25.2	31.4

QUANTITIES IN MILLION GALLONS PER DAY

1928	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
Feb.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	18.7	22.2	21.2	14.4	22.6	25.5	31.9
2		3.5	16.8	20.3	19.4	12.9	20.2	22.8	28.5
3		3.5	15.5	19.0	18.1	12.6	19.8	22.3	27.9
4		3.5	14.2	17.7	16.9	12.5	19.6	22.1	27.7
5		3.5	16.3	19.8	18.9	12.5	19.6	22.1	27.7
6		3.5	21.9	25.4	24.2	12.9	20.2	22.8	28.5
7		3.5	24.5	28.0	26.8	14.2	22.3	25.2	31.4
8		3.5	85.9	89.4	85.4	26.4	41.5	46.7	58.3
9		3.5	46.5	50.0	47.8	18.2	28.6	32.2	40.2
10		3.5	36.8	40.3	38.5	16.3	25.6	28.8	36.0
11		3.5	32.3	35.8	34.2	15.5	24.3	27.4	34.2
12		3.5	29.7	33.2	31.7	14.2	22.3	25.2	31.4
13		3.5	25.8	29.3	28.0	14.2	22.3	25.2	31.4
14		3.5	29.7	33.2	31.7	23.2	36.4	41.1	51.3
15		3.5	29.7	33.2	31.7	18.7	29.3	33.1	41.4
16		3.5	26.5	30.0	28.7	16.6	26.1	29.4	36.7
17		3.5	23.9	27.4	26.2	16.2	25.4	28.7	35.8
18		3.5	24.7	28.2	26.9	15.5	24.3	27.4	34.2
19		3.5	20.7	24.2	23.1	15.5	24.3	27.4	34.2
20		3.5	20.7	24.2	23.1	15.5	24.3	27.4	34.2
21		3.5	18.5	22.0	21.0	14.4	22.6	25.5	31.9
22		3.5	19.4	22.9	21.9	17.4	27.3	30.8	38.4
23		3.5	27.1	30.6	29.2	23.9	37.5	42.3	52.8
24		3.5	27.1	30.6	29.2	19.4	30.5	34.3	42.9
25		3.5	25.2	28.7	27.4	18.2	28.6	32.2	40.3
26		3.5	21.9	25.4	24.2	16.6	26.1	29.4	36.7
27		3.5	20.7	24.2	23.1	16.2	25.4	28.7	35.8
28		3.5	18.5	22.0	21.0	15.5	24.3	27.4	34.2
29		3.5	18.2	21.7	20.7	14.2	22.3	25.2	31.4
Total		101.5	757.4	858.9	820.2	473.8	743.6	838.6	1047.3
Average			26.2	29.6	28.3	16.3	25.6	28.9	36.1
Maximum			85.9	89.4	85.4	26.4	41.5	46.7	58.3
Minimum			14.2	17.7	16.9	12.5	19.6	22.1	27.7

QUANTITIES IN MILLION GALLONS PER DAY

1928	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
March	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	17.4	20.9	19.9	14.2	22.3	25.2	31.4
2		3.5	15.5	19.0	18.1	12.9	20.2	22.8	28.5
3		3.5	13.6	17.1	16.3	12.9	20.2	22.8	28.5
4		3.5	13.6	17.1	16.3	12.9	20.2	22.8	28.5
5		3.5	12.6	16.1	15.4	12.6	19.8	22.3	27.9
6		3.5	11.9	15.4	14.7	11.9	18.7	21.0	26.3
7		3.5	11.2	14.7	14.0	11.6	18.2	20.5	25.6
8		3.5	10.2	13.7	13.1	12.5	19.6	22.1	27.6
9		3.5	40.7	44.2	42.2	37.4	58.7	66.1	82.6
10		3.5	31.7	35.2	33.6	20.6	32.3	36.5	45.6
11		3.5	25.8	29.3	28.0	20.0	31.4	35.4	44.3
12		3.5	24.5	28.0	26.7	18.1	28.4	32.0	40.0
13		3.5	23.2	26.7	25.5	16.3	25.6	28.8	36.0
14		3.5	23.2	26.7	25.5	18.2	28.6	32.2	40.3
15		3.5	21.3	24.8	23.7	16.2	25.4	28.7	35.8
16		3.5	29.1	32.6	31.1	20.0	31.4	35.4	44.3
17		3.5	29.7	33.2	31.7	21.9	34.4	38.7	48.4
18		3.5	31.0	34.5	32.9	23.9	37.5	42.3	52.8
19		3.5	25.8	29.3	28.0	21.2	33.3	37.5	46.8
20		3.5	21.9	25.4	24.2	20.0	31.4	35.4	44.3
21		3.5	21.9	25.4	24.2	18.7	29.4	33.1	41.4
22		3.5	21.3	24.8	23.7	18.2	28.6	32.2	40.3
23		3.5	25.2	28.7	27.4	17.4	27.3	30.8	38.4
24		3.5	26.5	30.0	28.6	16.8	26.4	29.7	37.2
25		3.5	24.5	28.0	26.8	16.8	26.4	29.7	37.2
26		3.5	25.2	28.7	27.4	15.5	24.3	27.4	34.2
27		3.5	41.2	44.7	42.7	15.5	24.3	27.4	34.2
28		3.5	31.0	34.5	32.9	14.8	23.2	26.2	32.7
29		3.5	27.1	30.6	29.2	14.2	22.3	25.1	31.4
30		3.5	134.0	137.5	131.3	42.6	66.9	75.4	93.3
31		3.5	73.6	77.1	73.7	29.7	46.6	52.5	65.8
Total		108.5	885.4	993.9	948.8	575.5	903.3	1018.0	1271.6
Average			28.6	32.0	30.6	25.0	29.2	32.8	41.0
Maximum			134.0	137.5	131.3	42.6	66.9	75.4	93.3
Minimum			10.2	13.7	13.1	11.6	18.2	20.5	25.6

QUANTITIES IN MILLION GALLONS PER DAY

1928	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
April	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	54.9	58.4	55.8	24.6	38.7	43.5	54.4
2		3.5	45.2	48.7	46.6	21.3	33.4	37.6	47.1
3		3.5	38.8	42.3	40.4	20.0	31.4	35.4	44.2
4		3.5	34.9	38.4	36.7	18.2	28.6	32.2	40.3
5		3.5	32.3	35.8	34.2	17.4	27.3	30.8	38.5
6		3.5	29.7	33.2	31.7	19.4	30.5	34.3	42.9
7		3.5	142.0	145.5	139.0	51.6	81.1	91.2	114.1
8		3.5	70.4	73.9	70.6	31.0	48.7	54.8	68.5
9		3.5	53.5	57.0	54.5	27.8	43.6	49.2	61.4
10		3.5	63.9	67.4	64.4	34.9	54.8	61.7	77.1
11		3.5	102.0	105.5	100.8	40.0	62.8	70.6	88.4
12		3.5	106.0	109.5	104.5	37.4	58.7	66.0	82.6
13		3.5	75.5	79.0	75.6	31.7	49.8	56.0	70.1
14		3.5	63.9	67.4	64.4	30.4	47.7	53.7	67.2
15		3.5	54.9	58.4	55.8	27.1	42.54	48.0	60.0
16		3.5	47.8	51.3	49.1	23.9	37.5	42.3	52.8
17		3.5	41.9	45.4	43.4	22.0	34.53	38.8	48.6
18		3.5	38.8	42.3	40.4	20.5	32.2	36.2	45.3
19		3.5	34.9	38.4	36.7	19.4	30.5	34.3	42.9
20		3.5	38.8	42.3	40.4	21.3	33.4	37.6	47.1
21		3.5	36.1	39.6	37.8	23.8	37.4	42.0	52.6
22		3.5	72.4	75.9	72.4	37.5	58.9	66.2	83.0
23		3.5	104.0	107.5	102.6	49.0	76.9	86.6	108.2
24		3.5	72.4	75.9	72.4	37.5	58.9	66.2	83.0
25		3.5	58.8	62.3	59.5	31.0	48.7	54.8	68.5
26		3.5	49.1	52.6	50.2	27.8	43.7	49.2	61.5
27		3.5	79.5	83.0	79.4	45.9	72.0	81.2	101.3
28		3.5	77.5	81.0	77.4	40.6	64.0	71.9	89.8
29		3.5	67.2	70.7	67.5	35.5	55.8	62.8	78.5
30		3.5	70.4	73.9	70.5	32.9	51.7	58.0	72.7
Total		105.0	1857.5	1962.5	1874.7	901.4	1415.8	1593.1	1992.6
Average			61.9	65.4	62.5	30.0	47.3	53.1	66.4
Maximum			142.0	145.5	139.0	49.0	76.9	86.6	108.2
Minimum			36.1	39.6	37.8	17.4	27.3	30.8	38.5

QUANTITIES IN MILLION GALLONS PER DAY

1928	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6)+57.1%	Total Runoff at Cantrell Creek Intake (6)+76.9%	Total Runoff at Bradley Creek Intake (6)+121.1%
	By Pumping	By Gravity							
May	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1		3.5	83.4	86.9	83.0	33.6	52.8	59.0	74.3
2		3.5	65.2	68.7	65.6	29.7	46.6	52.5	65.7
3		3.5	54.9	58.4	55.8	27.1	42.6	48.0	59.9
4		3.5	47.8	51.3	49.0	25.2	39.6	44.5	55.7
5		3.5	43.9	47.4	45.3	23.9	37.5	42.3	52.9
6		3.5	45.2	48.7	46.5	37.5	58.9	66.3	83.0
7		3.5	116.0	119.5	114.1	93.0	146.0	164.5	206.0
8		3.5	106.0	109.5	104.6	63.9	100.3	112.9	141.4
9		3.5	81.4	84.9	81.0	48.4	76.0	85.5	106.9
10		3.5	67.2	70.7	67.5	41.4	65.1	73.4	91.7
11		3.5	56.2	59.7	57.0	36.2	56.8	64.0	80.1
12		3.5	50.4	53.9	51.5	32.0	50.2	56.6	70.8
13		3.5	43.9	47.4	45.6	29.7	46.6	52.5	65.7
14		3.5	41.3	44.8	42.8	27.8	43.7	49.2	61.5
15		3.5	38.1	41.6	39.8	26.5	41.6	46.9	58.7
16		3.5	36.1	39.6	37.8	24.6	38.7	43.5	54.5
17		3.5	32.9	36.4	34.8	23.9	37.5	42.3	52.9
18		3.5	34.3	37.8	36.1	23.2	36.4	41.0	51.4
19		3.5	32.9	36.4	34.8	22.0	34.5	38.9	48.6
20		3.5	32.9	36.4	34.8	21.3	33.5	37.7	47.1
21		3.5	32.9	36.4	34.8	20.7	32.5	36.6	45.8
22		3.5	32.9	36.4	34.8	23.9	37.5	42.3	52.9
23		3.5	31.7	35.2	33.6	45.8	71.9	81.0	101.3
24		3.5	31.7	35.2	33.6	43.9	68.9	77.6	97.0
25		3.5	29.0	32.5	31.0	27.1	42.5	47.9	60.0
26		3.5	31.7	35.2	33.6	37.5	58.9	66.2	83.0
27		3.5	54.3	57.8	55.2	25.2	39.6	44.5	55.7
28		3.5	54.9	58.4	55.7	23.3	36.6	41.2	51.6
29		3.5	43.3	46.8	44.7	20.7*	32.5	36.6	45.8
30		3.5	42.0	45.5	43.4	20.7*	32.5	36.6	45.8
31		3.5	36.8	40.3	38.5	20.7*	32.5	36.6	45.8
Total		108.5	1531.2	1639.7	1566.3	1000.4	1570.8	1768.6	2213.5
Average			49.4	52.9	50.5	32.3	50.7	57.0	71.4
Maximum			116.0	119.5	114.1	93.0	146.0	164.5	206.0
Minimum			29.0	32.5	31.0	20.7	32.5	36.6	45.8

*Observed runoff for last three days not available. Minimum discharge for month used to complete record.

QUANTITIES IN MILLIONS OF GALLONS

Year and Month	NORTH FORK SWANNANOA RIVER					SOUTH FORK MILLS RIVER			
	DIRECTED TO CITY		Recorded at North Fork Gauging Station	Total Runoff at North Fork Gauging Station	Total Runoff at Burnett Dam Site 95.5% (4)	Total Runoff at Pink Beds Gauging Station	Total Runoff at Mills River Intake (6) + 57.1%	Total Runoff at Cantrell Creek Intake (6) + 76.9%	Total Runoff at Bradley Creek Intake (6) + 121.1%
	By Pumping	By Gravity							
1926	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Area in Sq. Mi.		22.0	22.0	21.0	9.9	16.0	18.4	24.1
Jan.	†	90.2*	1261.0*	1351.2*	1290.4*	1067.0*	1676.2*	1887.5*	2359.1*
Feb.		83.0	783.5	866.4	827.7	981.0*	1541.1*	1735.4*	2169.0*
March		91.5	863.8	956.4	913.7	686.2	1077.3	1213.4	1517.8
April		81.4	875.9	957.6	915.0	730.6	1147.1	1292.2	1615.8
May		109.8	436.2	545.9	521.1	363.6	570.4	643.1	803.5
June		133.3	116.7	250.0	239.6	215.6	338.4	380.8	476.3
July	99.3	10.3	298.8	408.4	390.2	267.3	419.5	472.7	591.3
Aug.	103.7	33.1	497.2	633.9	605.8	326.5	511.7	577.6	721.8
Sept.	18.6	90.9	511.0	620.5	592.5	180.5	283.2	319.0	399.1
Oct.	20.0	92.0	316.8	428.7	409.5	178.7	280.3	315.8	395.2
Nov.	13.5	96.5	1718.5	1828.4	1646.1	620.2	973.8	1096.7	1371.3
Dec.		110.7	1731.9	1843.1	1760.4	722.9	1134.8	1279.0	1597.8
Total	255.1	1022.7	9411.3	10690.5	10112.0	6340.1	9953.8	11213.2	14018.0
1927									
Jan.	37.0	89.0	904.8	1031.1	985.5	541.0	849.0	956.0	1196.4
Feb.	87.8	42.7	1259.4	1389.9	1327.5	494.7	776.2	874.6	1093.9
March	24.7	84.2	1587.8	1698.0	1621.5	840.0	1319.0	1485.9	1857.1
April	7.46	98.6	974.2	1080.4	1031.9	436.3	684.6	772.2	964.4
May	0.3	103.6	380.7	474.6	453.0	312.6	490.8	553.1	691.2
June	0.0	81.1	907.8	988.9	944.1	333.2	522.7	589.6	736.8
July	0.0	109.2	256.2	365.4	349.1	283.0	444.6	500.5	625.6
Aug.	0.0	108.5	156.2	264.8	252.7	402.5	631.9	712.2	889.7
Sept.	0.0	87.5	91.6	179.4	171.1	161.6	253.6	285.6	357.2
Oct.	0.0	93.3	182.4	275.5	262.9	229.4	360.4	405.5	507.2
Nov.	0.0	104.1	637.3	741.5	707.7	360.0	565.6	636.9	796.1
Dec.	0.0	108.5	1776.9	1885.4	1801.5	1047.5	1645.8	1853.0	2316.8
1927 Total	157.16	1110.3	9115.3	10374.9	9908.5	5441.8	8544.2	9625.1	12032.4
1928									
Jan.		108.5	835.3	943.7	901.3	683.4	1073.2	1209.0	1511.3
Feb.		101.5	757.4	858.9	820.2	473.8	743.6	838.6	1047.3
March		108.5	885.4	993.9	948.8	575.5	903.3	1018.0	1271.6
April		105.0	1857.5	1962.5	1874.7	901.4	1415.8	1593.1	1992.6
May		108.5	1531.2	1639.7	1566.3	1000.4	1570.8	1768.6	2213.5
Sub-total		532.0	5866.8	6398.7	6111.3	3634.5	5706.7	6427.3	8036.3
Grand Total	412.26	2665.0	24393.4	27464.1	26131.8	15416.4	24204.7	27265.6	34086.7

†Amount shown by gravity represents total delivered to City by pumping and gravity Jan. to June.

*These items represent computed quantities where the observed flow was not available.

These results show that the average daily runoff per square mile for the period from January 1, 1926, to May 31, 1928, was as follows:

For the area above Burnett gauging station on North Fork of Swannanoa River-----1.41 M.G.
For the area above Pink Beds gauging station on South Mills River -----1.77 M.G.

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